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FALLACIES OF THE EVIDENCE TAKEN ON THE PATENT LAW INQUIRY.—No. III.

MR. WEBSTER'S evidence is in the main so truthful and instructive that we scarcely like to say anything that may appear to disparage it; but the great interests at stake, the scientific and industrial progress of the nation, render it necessary that we should speak out, without fear or favour. When he asserts that property in invention is justifiable and necessary, that preliminary examination into the claims of applicants for such property and reformation of our system of patent litigation are requisite, he speaks wisely, and as one having authority by reason of his practical acquaintance with the subject; but when he begins to draw distinctions between major and minor inventions, and the difference between invention-right and copyright, he evidently leaves *terra firma*, and becomes liable to all the mischances which the slippery foothold of the quagmire he enters on occasions to those who attempt to travel thereon.

If a man makes a step in advance, whether it be a long step or a short one, if it be appreciable as to its effects in an industrial and commercial point of view, it is of importance to the public interests that such step should be made; hence it is wise policy that the making of such steps should be assisted. So Mr. Webster was slipping into the quagmire when he gave encouragement to the notion which Mr. Grove uttered, that small inventions should entitle their originators to short patents only, whilst large inventions should entitle their inventors to long patents, which he did in his answers to Questions 590 to 596 (page 49 of Report). He could not have fully considered how impossible it is to judge correctly of what is large and what is small, and, further, that any such distinction would be very damaging to many inventions, because the effect of authoritatively declaring that inventions are small ones would, in the many cases where a mistaken judgment would be given, be no small hindrance to the respective patentees in their efforts to obtain capital. If, in order to make as close a bargain with the inventor as can be made, the law should enact that short term patents at a less cost should be grantable at the option of the applicant, that would seem to be an unobjectionable plan, if patents are to cost anything at all; but no absolute restriction ought to be adopted. No one thinks it proper to restrict the proprietary right in toys and gewgaws, but, on the contrary, allows the same amplitude as is allowed to articles of the highest utility and beauty. To draw any analogy from the legal enactments as to designs and patterns properly so termed is utterly fallacious, because they have reference to articles of fashion, and are, moreover, matters in which the impress of the personality, so to speak, of their original producers, like so-called patent-medicines, has great weight with the buying public, and go to aid legal protection; and even in their case it may be doubted whether a perpetual, or at least a life-long property, defeasible by a certain period of disuse, is not for them and for patents also the proper plan to adopt. "*Esto perpetua*," said the late lamented President of the Inventors' Institute, Sir David Brewster, and when he said it he gave utterance to a great thought. Another stumbling-block produced its effect on Mr. Webster; that was the assertion of an innate difference between copyright and patent-right by reason of different persons inventing the same thing—see question 787, page 65 of Report.

Now, taking into account the fact that copyright is strictly restricted to the *form* in which ideas are put, it is a rare thing, where no communication or fraud has taken place, for two distinct persons to produce the same invention; and if invention-right were as cheap as copyright, there would be no objection to its being limited in the same way.

As to the working of the present Patent Law Mr. Webster has some very appropriate remarks. He states (Questions 605, 606, 607, 608):—

But do you consider that in practice the provisional specification does sufficiently describe the nature of the invention?—No, I do not, I consider it has sins of omission as well as commission. It does not now sufficiently describe the nature of the invention, and where it does it very often does more, putting in those means which become subjects of embarrassment.

You mean to say that those words in the rule are, in fact, an extension of the words of the Act, and there is little question that they are *ultra vires*?—Yes, I have no doubt they are; if there had been anybody to represent this to the law officers of the Crown it would have been found out. Certainly it is against the spirit of the Act.

And it is beyond the words of the Act, is it not?—It is beyond the words of the Act. That was contested on the Bills of 1851. We had two classes of people one was the registration party, who said, "Let a man register what he pleases, and have no inquiry; let him create what power of suing he will"; and the other party insisted upon having a complete specification in the first instance, as they have in France and elsewhere, but it was thought that the true course was the medium course, which resulted in this provisional specification.

But you consider, if I understand rightly, that now in practice inventions are frequently not sufficiently described in the provisional specification, and yet these provisional specifications are accepted by the law officers of the Crown?—I do consider that that is so; and it cannot possibly be otherwise

Sir Roundell Palmer, who was examined after Mr. Webster, gave evidence setting forth his notion, which everyone is now well acquainted with, that patents for inventions are obstructive monopolies, which hamper our commerce and manufactures, and ought therefore to be abolished. This notion is so thoroughly irrational, and has been so often refuted in the columns of the SCIENTIFIC REVIEW, and will have to be dealt with when we come to review Mr. Macfie's evidence, that we need not now occupy our space with any refutation of it. Suffice it to say that he presented to the Committee no new views. He did, however, present them with information on the subject of the enormous cost of litigating patents in Chancery under the present system.

Mr. Theodore Aston gave evidence in favour of the continuance of the Patent Laws in an amended form, and illustrated his evidence by some interesting statistical tables he had prepared. He was, however, in favour of a system of Governmental interference with inventors that we should not like to see carried out.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

DECEMBER 5, 1871. Joseph Cubitt, Esq., Vice-President, in the chair.—The paper read was "On the Stresses of Rigid Arches, and other Curved Structures," by Mr. William Bell, M. Inst. C.E.

The author, after adverting to his method of constructing a curve of equilibrium for an arch unequally loaded with continuous or discontinuous weights, or under oblique pressures, proceeded to apply it to the determination of the stresses on rigid arches and other curved structures.

As the consideration of an arch of masonry was more simple than that of a rigid arch, a preliminary illustration was given by an examination of the Pont-y-tu-Prydd, an arch of small stability, with the peculiarity that its spandrels were constructed with cylindrical openings. The effect of these openings was described. To show the nature of the change of the curve of equilibrium by oblique pressure of the backing, this curve was drawn on the supposition that the backing was a perfect fluid, pressing at right angles to the back of the arch. The action of a passing load in increasing the stress upon the masonry was also examined.

The stresses of a rigid arch had hitherto been a subject of considerable difficulty, owing to the intricate nature of the mathematical analysis it was necessary to employ: and the labour of applying formulæ to trace the variation of stress from point to point was considerable. Still, before the transverse sections of arch ribs could be proportioned to the stresses coming upon them, a knowledge of this variation was indispensable.

The main object of the paper was to show that the stresses at every point of an arch rib could be determined by a diagram, and that some questions, such as where the form of the rib was neither circular nor parabolic, and when the pressure was oblique, which would be almost intractable by analysis, could be readily solved.

The curve of equilibrium being the locus of the resultant of all the outward forces, the bending moment was the pressure in the direction of the curve multiplied by the perpendicular upon the tangent. The curve having been determined, the stress caused by the bending moment could be ascertained, and this, added to the uniform compression, was the total stress at any point. By shifting vertically the positions of the points of the curve at the crown and springing, the stress could be indefinitely varied, and the curve could be made to satisfy the conditions of the rigid arch of invariable span, or the rigid arch with the ends fixed.

These conditions were then investigated, and gave the following results. The neutral line of the arch rib having been divided into equal parts, and the bending moments at each of these parts obtained from the curve of equilibrium, when the ends were fixed the sum of all the bending moments had to be made equal to zero; when the rib was of invariable span the sum of the bending moments, each multiplied by the vertical ordinate of the point to which it corresponded, had to be made equal to zero; and when the ends were fixed, and the rib of invariable span, the above conditions had both to be satisfied. When the section of the rib changed from point to point, each bending moment was to be divided by the moment of inertia of the cross section corresponding to it before entering it in the summation. It was then remarked that where the curve of equilibrium touched the surface of the rib the compressive stress was doubled, trebled, or quadrupled, according as the section was I or box-shaped, tubular, or of the form of a solid rectangle. For vertical forces only the bending moment at any point was equal to the horizontal thrust multiplied by the length of the vertical line between the curve of the rib and the curve of equilibrium.

A mathematical investigation was entered into for a circular rib, considered as a voussoir arch, or rigid arch with the ends fixed, in a similar manner to Mr. Airy's treatment of the circular rib of invariable span. It was shown that the stresses could be equally well ascertained by diagram as by mathematical investigation. When a moving load was the only force acting on an arch rib, the curve of equilibrium was two straight lines, meeting in an apex vertically above the load. As the load moved the locus of this apex depended on the condition of the rib, as to whether it was rigid, or in the state of a voussoir arch. The action of a uniformly distributed load was then examined, and the circular rib compared with the parabolic. It was remarked that a straight or curved girder might be considered as an arch of any rise, but without horizontal thrust, and it was shown that, by drawing any curve of equilibrium for the weights, continuous or discontinuous, acting on the girder, considering it as an arch, the stress at any point was the horizontal thrust multiplied by the vertical ordinate.

The action of oblique forces was then entered into, and the case of the curved gates of the Victoria Docks was examined.

The stresses on the elliptical caissons used in the foundation of the Thames Embankment were next ascertained by construction. It appeared that when the eccentricity of an ellipse under normal pressure was small, the curve of equilibrium was nearly a circle, whose radius was the mean between the length of the major and minor semi-axes of the ellipse, and that if a boiler, which was an arch in tension instead of in compression, were not truly cylindrical, there would be considerable transverse in addition to the tangential stress, and if the deviation from an exact circle were greatest at the riveted joints the stress would be greatest at the weakest parts. It was then remarked that at an ordinary lap joint, or at a part where the deviation of form amounted only to half the thickness of the plating, the stress at the surface of the iron was four times that due to the uniform pressure of the steam. This result, which showed how greatly a boiler might be weakened by an imperfection of form too slight to be detected by the eye, was not, in the author's opinion, generally known. There could be little doubt that incorrectness of form, the evidence of which was destroyed when a boiler exploded, was one of the chief causes, and hitherto an unsuspected cause, of many of the boiler explosions which occurred from time to time throughout the country.

The last example chosen was the somewhat complex case of the roof of the St. Pancras Station, Midland Railway. The form of the rib differed from the circle and parabola, the section varied to some extent near the springing, and as the action of the wind on the roof was considered, the question was also one of oblique forces. The curves of equilibrium for the roof, acted on only by its own weight, were first drawn. For the actual condition of the rib, namely, that of a rigid arch with the ends fixed, the curve was contained everywhere within the depth of the rib. For a pressure of wind of 40 lbs. per square foot the curve showed two maximum stresses of 4·08 tons and 4·14 tons per square inch.

The arch rib had been treated as of invariable span, but real or virtual alterations of span might be caused by changes of temperature, a yielding of the abutments, and the compressibility of the arch rib itself. It became then an important practical question to determine for wrought-iron arches how much the stresses might be altered by a small alteration of the span. The method of ascertaining this generally was then described, and it was found that a wrought-iron rib of 200 feet span, 20 feet rise, of an I or box-shaped section, and loaded uniformly, might have the stress at the crown increased from 4 tons to 6¼ tons per square inch. This would happen if the abutments each yielded ¼ an inch under the thrust, and the temperature were reduced 60° below that at which the parts of the rib were put together. This result included the stress caused by the compressibility of the iron.

In order to draw the elastic curve of the rib it was then shown how to find the displacements of the different points by change of temperature, compressibility of the metal, and action of the bending moment. The deflection of the crown was the alteration of the rise of the rib as found by this process. Applying it to the case of the rib of the St. Pancras Station roof, the deflection of the crown was found to be 2 inches, while observation had given from $\frac{1}{16}$ to $\frac{1}{2}$ inch, so that the agreement of calculation with observation was very close.

The author proposed to measure stresses by direct observation of the extension or compression of a small length of the material of a structure. For a stress of 1-5th ton per square inch, the extension of a length of 50 inches of wrought iron was $\frac{1}{1000}$ of an inch, which, if magnified fifty times, would be read as $\frac{1}{20}$ of an inch by the eye. During the testing of a structure two microscopes, magnifying fifty diameters, with scales in their eye-pieces, fixed about 50 inches apart, would measure stresses of 1-6th of a ton per square inch in the most direct manner, and the stresses could be measured at the critical points of a structure.

The author thought that this method of observation might even be useful in another way, if, as was probable, inferior kinds of wrought iron approached to cast iron in the scale of their extensibility under moderate stresses. By taking an observation where the stress could be accurately determined by calculation, the quality of the iron which had been used in a structure might be ascertained.

ZOOLOGICAL SOCIETY OF LONDON.

NOVEMBER 21, 1871. Professor Flower, F.R.S., V.P., in the chair.—Mr. Sclater exhibited and made remarks on a fine skin of *Ateles variegatus*, Wagner (*A. bartletti*, Gray), which had been received in a collection from Oyapok, on the eastern limits of Cayenne, being a new locality for this species. A communication was read from Professor Owen, F.R.S., containing the third of a series of memoirs on the osteology of the marsupials. In this memoir Professor Owen entered at full length into the modifications observable in the cranium of the three known species of Wombats (*Phascolomys*). Dr. Gunther, F.R.S., read a report on several important collections of fishes which had been recently obtained for the British Museum collection. Amongst them were many new forms from the Pacific, obtained through the agency of the Museum Godefroianum of Hamburgh; several novelties from Celebes, collected by Dr. B. Meyer; and some interesting fishes from Tasmania, transmitted by Mr. Morton Allport, F.Z.S. Dr. Gunther called special attention to the occurrence of many well-known European forms of fishes in the Australian seas, and in explanation of this fact suggested that these might also occur as deep-sea fishes in the intermediate seas of the tropics. A paper by Mr. A. Anderson, F.Z.S., was read, containing notes on the raptorial birds of North-Western India. A communication was read from Messrs. G. Stewardson Brady and David Robertson, giving descriptions of two new species of British *Holothuroidea*. Mr. P. L. Sclater exhibited and described, under the name *Turtur aldabranus*, a specimen of a new species of dove of the genus *Turtur*, from the coral reef of Aldabra, north of Madagascar. This specimen has been lately living in the society's gardens, having been presented by Mr. E. Newton, F.Z.S. A paper by Mr. John Brazier, C.M.Z.S., of Sydney, N.S.W., was read, giving descriptions of seven new species of the genus *Helix*, and of two fluviatile Mollusks from Tasmania. A second paper, by Mr. Brazier, contained notes on the specific

names of certain land-shells from the South Sea Islands. A communication was read from Count Thomas Salvadori, C.M.Z.S., containing a note on *Ceriornis caboti*. A communication was read from Mr. W. T. Blanford, C.M.Z.S., giving a description of a new Himalayan finch, proposed to be called *Procarduelis pubescens*, from Sikim.

December 5, 1871. John Gould, Esq., F.R.S., V.P., in the chair.—The secretary read a report on the additions that had been made to the society's menagerie during the months of October and November, 1871; and called particular attention to a young female specimen of the Cape fur-seal (*Otaria pusilla*), presented by H.E. Sir Henry Barkly, Governor of the Cape Colony, being the first example of this interesting animal received alive in Europe. A letter was read from Dr. Burmeister, F.M.Z.S., of Buenos Ayres, containing remarks on Messrs. Sclater and Salvin's "Synopsis of the Cracidæ," published in the society's "Proceedings" for 1870. Dr. E. Hamilton exhibited and made some remarks on an adult skull of the newly-discovered Chinese deer (*Hydropotes inermis*), and compared it with an immature skull of the same species exhibited by Mr. R. Swinhoe at a meeting of the society, 10th February, 1870. Dr. Hamilton also drew attention to the statement made by his correspondent respecting the wonderful fecundity of this animal, which tended to corroborate the facts stated by Mr. Swinhoe on that occasion. Mr. Sclater exhibited and remarked on a skin of the water opossum (*Chironectes variegatus*), which had been sent to him by Mr. Robert B. White, C.M.Z.S., from Medillin, U.S of Columbia. Professor Newton, F.Z.S., exhibited and made remarks on the humerus of a pelican, (believed to be *Pelecanus crispus*), which had been found in the English fens. A communication was read from Surgeon Francis Day, F.Z.S., Inspector-General of Fisheries of British India, containing remarks on the fresh-water siluroids of India and Burmah, with observations on the range of the species, their classification, and general geographical distribution. Mr. A. G Butler read a paper on a small collection of butterflies made at Loando, the capital of the Portuguese settlements in Angola. A second paper by Mr. Butler gave the description of a new genus of lepidoptera, allied to *Apatura*, which was proposed to be called *Eulaceura*. A paper by Mr E. A. Smith was read, containing a list of species of shells from the slave coast, West Africa, collected by the late Commander Knocker, R.N., the majority of which had been dredged at Whydah, on the Dahomey shore. Professor Newton communicated some notes by Herr Robert Collelt, of Christiana, on the singular symmetry of the skull in Tengmalm's owl (*Strix tengmalmi*). Mr. Sclater read the third and final portion of a series of notes on rare or little-known animals now or lately living in the society's gardens. Mr. Sclater gave an account of a collection of birds from Oyapok, on the river of the same name, which divides Cayenne from the northern frontier of Brazil, amongst which were two species believed to be undescribed, and proposed to be called *Ochthoeca murina* and *Heteropelma igniceps*. A third communication from Mr. Sclater contained remarks on the species of the genera *Myiozetetes* and *Conopias*, belonging to the family Tyrannidæ. Mr. E. W. H. Holdsworth, F.Z.S., read some notes on the red-spotted cat (*Felis rubiginosa*), of Ceylon, and its varieties. Mr. D. G. Elliot, F.Z.S., read a paper on felidæ, rectifying the synonomy of several species, and giving a more perfect description of one recently obtained from North-West Siberia, which he proposed to call *Felis euptilura*. Dr. Günther made a reply to some critical remarks in a paper by Surgeon Francis Day, read at a recent meeting of the society.

THE VICTORIA INSTITUTE.

The first meeting of the session was held in December, at the Rooms, 8, Adelphi Terrace, Mr. C. Brooke, F.R.S., in the chair. The honorary secretary, Captain F. Petrie, announced the election of the following new members.—The Archbishop of Canterbury, Bishop Trower, the Dean of Carlisle, Rev. J. G. Wood, F.L.S., Messrs. W. Fitzwilliam Dick, M.P., A. Coote, J. Houldsworth, G. Maberly, J. Nelson, and Major J. B. Smith; Revs. A. Edwards, T. Franklyn, T. Gorman, R. Phayre, Aubrey Price, J. Savile, P. Strutt, H. Warleigh, B. Whitelock, and S. Whitmee. Also a large number of works presented by the Royal and other societies in England and America. After which Mr. Cooper read his paper on "The Serpent Myths of Ancient Egypt." He began by stating that while much had been done for the elucidation of the ophiolatry of India, Greece, and Rome by many most able scholars, yet the serpent myths of Egypt—the oldest, most abundant, and best preserved of them all—had been but little attended to since the time of Champollion and Wilkinson. On the Continent it is true that MM. Pierret, Brugsch, and Lenormant had published a few isolated papers upon parts of the legends of hieroglyphy, but these had never been translated into English, and even the originals were but little known. He then described the three serpents peculiar to Egypt, two of which were objects of worship, and with one or other of which all the ideographic theology of Egypt was involved. This portion of the paper was exceedingly interesting, inasmuch as it was the result of a careful examination of the hieroglyphic, hieratic, and demotic writings in the Egyptian *papyri*, and also the works of every known author, both ancient and modern, who had written on the subject. Mr. Cooper then gave a careful *resumé* of the Egyptian ritual of the dead, of which the most perfect copy is at Turin—a work which may be traced back to the First Dynasty, but the final chapters of which were added as late as the period of the Ethiopian conquest of Egypt in the Twenty-sixth Dynasty, 665 B.C. He concluded by stating that the results of his examination of the subject proved that in the Egyptian mythology were preserved, in a corrupted form, many doctrines which were amongst those of revealed religion: also there was a belief in a monstrous evil being, typically represented as a serpent, whose office it was to accuse the righteous, oppose the Supreme Deity, Ra, and devour the wicked After referring to various other deductions, he concluded --Thus, then, for a time we roll back the papyrus on which is inscribed the story of the serpent Apophis. ask we why the Father of Mankind has permitted these records to contain, amid so many errors, much to testify of prophetic and Spiritual truth, seek then the answer in the words of the Apostle of the Gentiles, "God left not Himself without witness in the world," that even by the light of nature "all the world might become guilty before Him," and might in the fulness of time be saved by His Son, who is God over all, the victor over the great dragon, the old serpent, for ever—and evermore.

In the discussion which followed Mr. Titcomb drew attention to the serpent symbolism existing amongst the rude tribes of North America; and a large Egyptian drawing from a tomb was explained.

Mr. Rassam and Dr. Pritchard described the various serpents of India, and the Rev. G. Henslow those found in a fossil state.

In regard to the character in which Moses first wrote the first books of the Old Testament, Mr. S. M. Drach gave valuable evidence, both traditional and other, that it was in the Alphabetic character; and the Rev. S. Wainwright referred to the internal evidence there was confirmatory thereof.

After a few remarks by the Revs. C. Graham, T. Gorman, and C. Row, and Dr Fraser, it was stated that the Bishop of Gloucester would have been present to take part in the discussion, but was unavoidably prevented.

The next meeting was announced for the 8th of January.

Reviews.

Flints, Fancies, and Facts.—A Review of Sir C. Lyell's "Antiquity of Man," and similar works. By William Robinson, of Cambridge. London: Longmans, Green, and Co., Paternoster Row. 1871.

It would seem that orthodox cosmogonists have determined on a vigorous attack on the neoterics; for we have here another cheap though elaborate treatise on the subject, with special reference to the existence of pre-historic man, as evidenced by the so-called flint arrow-heads and implements. We confess that we have never been of the number of those who could perceive that anything more has ever been proved against the scriptural cosmogony than that it is by no means an exact scientific history of Creation. Moreover, we have found that all counter theories have sought for support by demanding assent to plausible hypotheses, with which some few facts might be considered to be in accordance. Mr. Robinson heads his work "Flints, Fancies, and Facts," and the tenor of it shows such a title to be well chosen. Doubtless flints are hard, and facts are hard and untractable; but fancies are plastic and mouldable. However, if facts are against us when we seek to establish a new principle, there is hope that fancies and flints will enable us to secure a favourable result; and this, it would seem, was the notion which prompted certain *savants* to resort to the flint beds. Mr. Robinson, however, maintains that hitherto the flints are by no means reliable supporters of any theory whatever, seeing they are usually either indecisive evidence or not of a *boná fide* character. Alluding to the great discoverer of the arrow-headed implements, M. Boucher de Perthes, Mr. Robinson says:—

On the 28th of March, 1863, M Boucher de Perthes, having been informed by one of the workmen that a piece of bone was to be seen in the gravel at the depth of about 15 feet, hastened to the spot, with great care disinterred it, and found it to be about half of a human jaw-bone. The discovery filled him with rapture, and the news flew through Europe. Addressing, in the following July, members of La Société d'Emulation, he said—"A series of circumstances combined to dispel all doubt. Everyone congratulated me; you, gentlemen, were not the last to do so; and these congratulations were sweet. Yes! my joy was great, and increased when many illustrious men of science, archæologists, geologists, anthropologists, whose practical acquaintance with these matters could not be disputed, came to Abbeville, and fully confirmed your opinion after prolonged examination." Vanity of vanities, and vexation of spirit! The triumphant joy of M Boucher de Perthes was rudely disturbed by the reviving scepticism of Englishmen The jaw-bone, which was to confound all gainsayers, became the signal of a new conflict. Rumours became very prevalent that the workmen of Picardy had manufactured haches, and placed both them and the jaw-bone in the gravel, that the sages might find them. This was perplexing and annoying; for the trumpets announcing the discoveries of that district had been blown very loudly, and in many lands, as examples of which, it is sufficient to say that Sir C. Lyell, at a meeting of which Prince Albert was president, spoke confidently of the flints; and that, in the French translation of his "Antiquity of Man," a note was inserted by the translator, describing the all-convincing evidence of the theory about the flints—démonstration victorieuse—supplied by the jaw-bone. To put an end to the doubts that had been raised, it was agreed, by palæologists of France and of this country, that someone not ignorant of practical geology should be sent from England to untie the Gordian knot A most suitable agent was found in Mr Keeping, who is now curator of the Woodwardian Museum, Cambridge, and to whose thorough honesty M. Boucher de

Perthes bears the most decided testimony. Two workmen were placed at his disposal; he remained on the spot eight days, and did not himself find a single implement; but seven were brought to his view by his two assistants, and so as to convince him that, in the same manner, any number might be procured; for though they came out of the gravel beds, he found on trial that the gravel where they had been buried was loose, as compared with the compact masses around. In short, the experiment convinced him that the workmen were not unaccustomed to manufacture the implements and hide them cleverly. It has also been ascertained that the piece of the human jaw had probably been obtained from a place in the neighbourhood where two skeletons were found in 1862, and inserted in the gravel just before M. Boucher de Perthes was summoned to see it. From the whole, we infer that rude flints may be found in the valley of the Somme, or in any other mass of gravel, in great abundance; that it is doubtful whether a single unquestionable specimen of ancient human workmanship has been discovered in the gravel of that valley, and that the theories which Lyell and Lubbock have deduced from the flint phenomena of that valley rest mainly, if not solely, on the ingenious frauds of the workmen.

In a letter to Dr. Falconer, dated April 26, 1863, M. Boucher de Perthes contends stoutly against the supposition that the French workmen would try to deceive, and yet more stoutly against the absurd supposition of their being able to outwit illustrious and learned men, the *élite* of France and England, and, toward the end of his letter, he adduces evidence in support of his opinions of the most decisive kind. A number of savants assembled; the piece of the jaw was produced, and the spirit of the man to whom it had belonged was summoned. Though M. Boucher de Perthes in one of his works had ridiculed spiritualism, he was gratified by observing that the summoned spirit manifested no animosity against him. The geological investigation which followed is far too good to be omitted:—

M. de L—— asked if the spirit of the man to whom belonged, when living, the jaw bone deposited in the museum and found at Abbeville, could come. Answer I am he.—Will you tell your name? Yoé.—Were you the victim of the great cataclysm? Yes.—Was the inundation of salt water? Yes. Did it come from the North? Yes. Were you the chief of the tribe? No.—A wise man? Yes. —Had you a language? Yes.—Was it by signs or words? By words.

Has your race disappeared from the earth? Yes.—Who are they who resemble it most? Those of the North.—The Lapps? Yes. Were they herbivorous? Herbivorous and carnivorous.—How long had your race inhabited the country at the time of the cataclysm? About two thousand years. How long is it since that? Nearly twenty thousand years.

What have I in my hand? A fragment of an arm in stone or flint.—Were there many men engulfed with you? Yes. Are there many human remains in the place where these flints were found? No, few. Did the bit of jaw that was found belong to you? Yes.—Will the upper part of the jaw be found? Yes.—Adhering to the skull? No.—Can you tell us where it will be found? At the time of the inundation the waters of the sea carried away with them enormous stones, which broke everything; one of these crushed my head; the pieces were separated and carried away by the water; some will be found at a few metres distant.—How many metres? A hundred.—In what direction? The answer, very decided To the north-east, and when he was made to repeat it, I say it, for the last time.

Can you say where your skull or other skulls may be found? In searching the ground about the pits already opened.—At what distance? Almost thirty metres from the spot where my lower jaw was found.—Are there any other fossil bones of men at Moulin Quignon? Yes.—And at Amiens? A few.—At how many metres of depth? Eight to ten.—Are there any near Paris? Near Paris fossil bones cannot be found, because at that epoch it was still under water. You must search a district older than Paris. You are in a good centre for your excavations. —Were you taller or shorter than we are? We were about 1 metre 60.—Was the cerebral system more developed among you? No. —Were you more intelligent? No, less intelligent.—Were there many races of men? Yes.

Were there lions? Neither tigers nor lions, but elephants.

Second Séance.

In what part of Paris can the bones of antediluvian animals be found? (See the map at Montrouge. In drawing a pencil over the map, he stopped where the two roads crossed, near Montrouge.)

Did your race belong to the Etruscan or Indian races? No, to the American.—Had you any knowledge of metals? No, we only knew stone, rude, not polished.—Were you strong? No. Cannibals? Yes; we ate animals also.—Why have so many hatchets been found at Saint Acheul? (The spirit of Yoé is gone without answering.)

George Cuvier is then summoned.

Questions put by Professor Z——.

Were you mistaken in saying that man came only at a very recent period? Yes.—How is it possible to know the race of men buried at Amiens and Abbeville? You must be skilled and fortunate in your researches, and when you have some materials which will put you in the right road, you will be no more able to doubt of that which has been regarded as an error of belief. The things found (trouvailles) will be the best information to aid you in these researches.—Can you, by the aid of Yoé, facilitate our researches? You know that we are not always permitted to guide man in what he does; we may sometimes inspire him, and then, with our counsels, which he follows, he succeeds. However, as that is not always possible, man must search. Often he finds, and then, at least, he has all the merit of his work.

The clear and precise answers of George Cuvier astonished all the auditory of savants, who, in a body, voted him their thanks. To shorten the length of the replies by the letters of the alphabet, two mediums had used the pencil. Their absent manner, occupied with other things, while writing with the rapidity of stenography, did not permit a doubt that the spirit of the great naturalist guided their hands, and that they acted only mechanically. Many words recalled the writing of the illustrious savant.

M. Boucher de Perthes does not fail to inform Dr. Falconer of the conclusive evidence of the truthfulness of Yoé:—

"I assure you that the defunct fossil declared last Thursday that it had been ground between two stones, and on the very same day the workmen found in the chalk, and at least a metre from the place where the jawbone was discovered, two large stones, under one of which were two haches, one of them broken, which had, perhaps, belonged to the poor dead man."

But Mr. Robinson is not content with discrediting the *bona fides* of so much confidently presented evidence of pre-historic man. He boldly attacks the conclusions of palæontologists as to the remoteness of the antiquity of that part of the substance of the earth from which their specimens are procured.—

Let it be supposed that some flints are produced which are certainly old and wrought. Were they found in peat? We have to inquire whether the peat is older than history. Were they found with bones in caves? We have to inquire whether the bones belong to "pre-historic times"; and if they do, whether they were buried in "pre-historic times." Were the flints found in beds of gravel? We have to inquire whether those deposits of gravel are older than history.

And in reference to peat Mr. Robinson remarks:—

Nearly twenty years ago, at the suggestion of Leonard Horner, Esq., Vice-President of the Royal Society, and by the zealous and generous co-operation of the Pacha of Egypt, 78 borings were made in the Nile valley, a short distance above the Delta. Accepting—inconsistently enough on the part of Sir C. Lyell—the chronology of Manetho, as interpreted by Lepsius, and assuming that the increment of the Nile mud has been at the rate of from 1-28 to 1-17 of an inch yearly, our calculators reach the conclusion that a brick met with at the depth of 60 feet may be 12,000 years old, and another work of art found at the depth of 72 feet may have "been buried more than 30,000 years ago." The calculation, it will be perceived, assumes that the soil of the valley has been deposited by the river, that the supply of mud by the river has never been greater than now, and that its accretion has been slow and uniform; all which points, instead of being plain and certain as the date of Solomon's Temple, are dubious as the dynasties of Manetho interpreted by Lepsius. Sir C. Lyell would perhaps admit that there was a time when the Nile first began to flow, and that the mud then swept onward in its course may have been immensely greater in amount than at present; for now "the fertilising effect of the inundation is exhausted, or nearly so." Curious evidence of the power of a new water-flow to create a deposit rapidly might be given from a page of Sir C. Lyell's works, but an example derived from another source may be preferable.—A portion of the channel of the Ouse, containing 800 acres, which was deserted by the Eau Brink Cut, has been warped up by the course of nature alone 25 feet in five or six years; and the whole 800 acres is now under cultivation, and worth from £30 to £70 an acre. 1300 acres were embanked from the Nene Wash eight years since, and let for nearly £2 an acre. Since that period the warping of the remainder, containing between four and five thousand acres, has been very rapid, amounting to, in parts, fourteen feet perpendicular by the mere operations of nature alone.

If, then, it were conceded that the entire depth of the Nile valley is to be attributed to the river, we have really no measure of its increment; for it may have amounted to fifty feet in the first century, but, besides this element of uncertainty, the whole theory of the formation of the sediment is open to question. To the east and west of Egypt lie the greatest sandy regions of the world, admitted to be the remains of an ocean which, at a time geologically recent, rolled over them. It must have rolled over Egypt too; and its residuum, we submit, is the substance of the soil of Egypt, which is called loess of the Nile, and consists of the pre-existing sand, with subsequent accumulations by the wind, drenched century after century by the waters of the overflowing river; which, as they have trickled down into the sand, have borne down with them fine mud held in solution, and so have changed the sand into loess. If the river by its annual inundation had formed the valley, there would have been stratification, at least lamination; whereas, in none of the excavations, were even laminæ met with in a single case. The borings, which were generally stopped by water at the depth of from 10 to 19 feet, brought up not a single trace of an extinct organic body, and but few organic remains of any kind; those few consisting of recent land and river shells, and bones of domestic animals. The borings brought up also fragments of burnt brick, and of pottery both coarse and ornamented. Suppose seven thousand years to have elapsed since the sea rolled over Arabia, Egypt, and the Libyan desert, since therefore the Nile began to flow through Lower Egypt, and we believe that all its phenomena as at present known are accounted for.

There is one consideration that has never been sufficiently canvassed by those who assume that incalculable periods of time must necessarily have been occupied in the formation of the substance of the earth, and that is, that the physical forces are capable of producing mighty results in a very short space of time. Persons acquainted with mechanics and chemistry know well the stupendous results which the powers of nature are capable of producing in a very limited time; therefore it may well be doubted whether, after all, the great antiquity assigned to the process of formation of much of the substance of the earth has not been considerably over-estimated; and we cannot do better than commend the concluding portion of this work to the attention of all geological and palæontological theorists:—

The normal condition of the crust of the earth as prepared for human residence is evidently that of hill and dale, a condition which prevails under the sea as truly as on the dry land. As a general rule the valleys were made for the rivers, and not by them, and though we are not bound to show how the present state of the valley in question was produced, we may suggest a very different theory from that of our authors, and one requiring far less credulity than theirs. It is admitted that the breadth of the English Channel has been materially increased, and that such change has occurred, as in many places, so in that part of the channel into which the river now empties itself. The valley, therefore, may have been formerly land-locked, and the bed of a large lake, which found its exit into the channel somewhat nearer to England than at present, it having since combined with the action of the sea to create the opening which now leads to Abbeville, and when the lake boundary was lowered, perhaps by several successive landslips, the people may have raised those lake-dwellings, the remains of which are said to be still apparent.

Did space permit, we would gladly sustain this view by reference to the great number of lakes which either all at once, or by successive changes, have sapped their boundaries and disappeared, leaving their traces in terraces such as appear in Glen Roy; such as in British Columbia swarm over an area of, at least, a hundred thousand square miles, terraces which led Mr Robert Chambers, after investigating those of Scotland, Ireland, England, France, Switzerland, Scandinavia, and North America, to write thus —"There is enough to justify a question regarding uniformity of level"—that is, high-water level—"not only throughout North America, but—bold as the idea may, in the present state of knowledge and of hypothesis, appear—between the old and new continents." When geologists shall cease from the notion of the solid crust of the earth moving about like dough in the process of kneading, they will be compelled to inquire about changes in the water level; and then will their science be emancipated, as was astronomy escaping from the deferent circle and the epicycles in which it long lay bound, and the "Antiquity of Man" will be consulted only at the dictate of curiosity, and with a smile or a sigh of wonder and pity.

The authors whose antiquarian opinions we have combated delight in glacial theories. For example, a vast mass of ice is assumed to have passed down the Rhone valley, and, turning by the Lake of Geneva, to have spread itself over the broad valley beyond, and then to have climbed the Jura to the height of 3450 feet. We are told of glaciers from fifty to a hundred and fifty miles long, and from one to three thousand feet deep, scooping out and removing the strata to the depth of two thousand feet. With gladness do we turn from these rampant fancies to more sober utterances. "There was a time, how many c[illegible] ago we know not, [illegible] every mount[illegible] of importance in Central Europe was covered with perpetual snow, and the head of every valley was occupied with one of those masses of ice which are called glaciers." Many of the supposed proofs of glacial action are probably to be traced to quite different causes; but assuming that the glacial theory of geologists has a basis of truth, a glacier melting "at the end of fifty or a thousand centuries" is a freak of imagination which might find a fitting place in some work like the "Arabian Nights," but ought not to have been introduced into a book pretending to be scientific. Mr. Bonney, firmly holding the glacial theory, with the caution of true science limits the glaciers to the heads of valleys, dates them by unknown centuries, and assigns to them moderate power. "I think that, generally, the scooping power of the glacier is very slight. . . . I cannot but believe that the lake valleys, whatever may have formed them, existed before the time when the glaciers passed along them, and that the glacier was much more a consequence of the valley, than the valley of the glacier." "There is also some reason to think that a few centuries ago the glaciers were considerably less extensive than they now are." M. Venetz "believes the period when this reflux of the glaciers began to have been early in the seventeenth century." Quite refreshing is the transition to such a work as Mr. Bonney's, from the prodigious assumptions of Boucher de Perthes, Lyell, and Lubbock, which latter are well described in the following words of Professor Huxley:—

"Men of science, like young colts in a fresh pasture, are apt to be exhilarated on being turned into a new field of inquiry, and to go off at a hand-gallop, in total disregard of hedges and ditches, losing sight of the real limitation of their inquiries, and to forget the extreme imperfection of what is really known. Geologists have imagined that they could tell us what was going on at all parts of the earth's surface during a given epoch; they have talked of this deposit being contemporaneous with that deposit, until, from our little local histories of the changes at limited spots of the earth's surface, they have constructed a universal history of the globe, as full of wonders and portents as any other story of antiquity."

We have no hesitation in recording our opinion that this work is a very clear *exposé* of the whole case as to pre-historic man from the orthodox side of the question, and as such submit it to the notice of our readers.

A Complete Course of Problems in Practical Plane Geometry, adapted for the use of Students preparing for the Examinations conducted by the Science and Art Department in First, Second, and Third Grade "Practical Geometry" Art, and subject I. "Practical Plane Geometry"—Science, including Problems from the various Examination Papers given on those subjects. By JOHN WILLIAM PALLISER, Second Master and Lecturer on Geometrical Drawing at the Leeds School of Art and Science, Mechanics' Institute, Head Master of the Art and Science Classes at the Leeds Young Men's Christian Association, etc. London: Simpkin, Marshall & Co., 4, Stationers' Hall Court, London, Birmingham and Bristol: The Educational Trading Company Limited.

THIS is another of those useful and cheap practical works which are doing much to render a national system of technical education, which is so great a desideratum of the present day, a matter of easy accomplishment. The work is specially intended for the use of candidates preparing for the examinations conducted by the Science and Art Department, who are recommended to work through the following:—I. First Grade (in National and other Schools).—Definitions on pages 4 and 5; 18 and 19, 34, 37 (1st column), 41 (1st column); and 55 (1st column). Problems Nos. 1 to 13; 16 to 30, 32 to 34; 36 to 41; 43, 47, 51 to 55; 59 to 67, 70, 72, 75, 77, 79, 85, 86, 91, 97, 101; 112 to 115; 120 to 123; 131, 135, 137, 138, 143, 164; and 187 to 189. II. Second Grade (for Pupil and School Teachers, and for Students in Schools of Art and Art Night Classes).—Definitions on pages 4 and 5; 18 and 19; 34; 37; 41; and 55 (1st and 2nd columns). Problems: Nos. 1 to 50; 51 to 98; 100 to 108; 111 to 119; 120 to 124; 131 to 151, 154, 156, 163, 164, 167, 173, 174, 175, 182, 183; 187 to 193; and 197 to 204. III. Third Grade (for those preparing for Group I. Art Master's Certificate); and IV. Science Subject I. (for Students in Science Schools and Classes). In all cases the student is carried a little further than is at present required (except in No. IV. Advanced and Honours), as in Government examinations it will be found that a more extensive knowledge is required each successive year.

Elementary Treatise on Physics, Experimental and Applied, for the Use of Colleges and Schools. Translated and Edited from Ganot's Elements de Physique (with the Author's sanction). By E. ATKINSON, Ph.D., F.C.S., Professor of Experimental Science, Staff College, Sandhurst. Fifth Edition, revised and enlarged. Illustrated by a Coloured Plate and 726 Woodcuts. London: Longmans, Green, and Co. 1872.

IN the present edition a somewhat larger and more elegant type and a larger page have been adopted. Thus, while adding twenty-eight new illustrations, and a considerable quantity of new matter, the actual number of pages has been diminished and the book has thereby been rendered more convenient.

In making the additions, while the wants of the general reader have been attended to, the principal aim of the editor has been, as in former editions, to render the book more useful to the student of physical science. Accordingly, as regards new matter, the main additions have been in those subjects which are calculated to take a permanent place in elementary instruction. We can confidently recommend this work as a most useful compendium of experimental science.

Geological Changes. The geological changes continually taking place on the earth's surface are innumerable, and require a sharp and experienced eye to keep pace with. When the work of creation is finally done, our planet will doubtless be an entirely different body. Geologists have long taught that at least the west coast of Greenland is slowly sinking below the sea. The doctrine is confirmed by Dr. Brown, who recapitulates the principal points of the evidence on which it rests. The following are among the facts which he enumerates:—Near the end of the last century a small rocky island was observed to be entirely submerged at spring-tide high water, yet on it were the remains of a house rising six feet above the ground; fifty years later the submergence had so far increased, that the ruins alone were left above water. The foundation of an old storehouse built on an island in 1776, are now dry only at low water. The remains of native houses are in one locality seen beneath the sea. In 1758 the Moravian mission establishment was founded about two miles from Fiskernæsset, but in thirty years they were obliged to move at least once the posts on which they rested their large *umiaks* or seal-skin boats. Some of the posts may yet be seen under the water. The dwellings of several Greenland families, who lived on Savage Point from 1721 to 1736, are now overflowed by every tide. In one locality the ruins of old Greenland houses are only to be seen at low water.

Raising a Sunken Vessel.—*From Hiogo, Japan*, it is reported that the barque *Pride of the Thames* which was sunk during the typhoon in July last,—*has been raised*. A local paper says, "the divers found her lying in a bed of sticky, black mud. They took the masts out of her and battened all hatches and mast holes down thoroughly, and then pumped her out. During this process they found twelve holes in her port quarter, which had to be plugged before she would lift—a job by no means easy to do in five feet of thick mud.

The Inventors' Institute.

On Thursday, the 30th November, the ninth session of the Inventors' Institute was inaugurated by a general meeting of members and a dinner.

THE OPENING MEETING.

The opening meeting took place at the rooms of the Institute, 4, St. Martin's Place, Trafalgar Square. There was a large attendance of members. Among them were Sir Antonio Brady (who presided), Mr. Hume Williams, Barrister-at-Law; Mr. Varley, sen., and Mr. Varley, jun., C. and E.E.; Mr. Hemans, C.E., F.R.S.; Mr. F. W. Campin, Barrister-at-Law; Mr. R. M. Latham (the Secretary), Mr. B. Burleigh, C.E.; Mr. Murray, Mr. Carttar (the Auditor), Mr. Smartt, Mr. Frederick Ransome, C.E.; Mr. M. Harris (Hon. Sec. Dinner Committee), Mr. A. J. Eli, and others.

Mr. R. M. Latham, the Secretary, commenced the proceedings by expressing the pleasure it gave him in announcing the opening of the ninth session of the Institute, and the fact that Sir Antonio Brady had accepted the chairmanship of the Council of the Institute, and would preside that day (applause).

Sir A. Brady then rose, and said that he could assure the meeting he felt highly honoured indeed at having been placed in the principal chair at such a meeting as this. As an humble follower in the paths of science, he naturally took a deep interest in all that concerned the welfare of art and science in this country. It might not be known to all present that at that moment a great scheme was before the Government for the promotion of art and technical education as applied to industry. He thought that this was a subject of the greatest importance - one that might well engage the attention of an institute like this, and one which should particularly interest the working-class members of it, for he believed some of the most valuable inventions of the present day came from that class (hear, hear). It had become perfectly clear that the Patent Laws of this country were not in a satisfactory state (hear, hear). They practically excluded the poor man from a race in which it was the interest of the country they should not cease to run, but they should be assisted to run. The inventors of England had probably done more for their country than any other class of persons. There was on the roll of inventors the name of Cort. There was no more illustrious name among them, yet, owing to the oppressive action of the law and the Government, Cort, after having expended all his patrimony and £20,000 more, ended his days in embarrassment and poverty, and his family were now in a painful state of destitution. Yet to that man we owed the great iron trade of England—one of the greatest industries that any country ever possessed—a trade which, it was no exaggeration to say, had added hundreds of millions to our wealth. Had our laws been in a proper state, Cort would have derived advantage from his discoveries and ended his days in wealth and honour. Instead of that he died poor, and those who had used his invention without paying him for such use reaped the benefit of what he created. Windsor, the inventor of gas lighting, was another case in illustration of the unsatisfactory state of the laws. However, what was especially needed was a proper Patent Law—one which would give security even to the poorest inventors, and enable them to derive a fair and just benefit from their study and labours. He would not weary the meeting by referring to names which are as well known to all present as they were to him. As they all no doubt know, Watt would never have received the benefit of his inventions only that he had a good friend in Boulton. Coming down to the present day, there was that distinguished member of the Council of the Inventors' Institute, Mr. Henry Bessemer, who spent £20,000 in the improvement of the manufacture of steel. If Mr. Bessemer had not been backed by great influence and wealth, possibly he would not at this moment be in the enjoyment of the benefit of his great and marvellous invention. The Patent Laws were at the bottom of all this injustice and evil (hear). They ought to be amended so as to bring them within the reach of the humblest (hear). He saw no reason why poor patentees should be called upon to pay £5000 or £10,000 a-year to the law-officers of the Crown for work which they had no time to perform, and which had much better be left alone. If we had a Patent Office something like that which exists in America, where inventions might be subject to some sort of scrutiny—limited, say, to the question of novelty—patentees might be left to risk the rest, and not acquire the questionable right, as they did at present, of going to law, which was an expensive amusement, as those who, like himself, were defending the rights of the public in Epping Forest were now finding out (a laugh). The existing Patent Laws meant simply a set of elaborate provisons for inducing men to go to law. If the Patent Laws could be simplified and their mode of procedure cheapened, it would be a great thing (applause). There was also another thing in which some improvement was needed. That was the length of interest which an inventor should have in his invention. No doubt brain and industry were the origin of the right of property, and inventors who passed their lives in perfecting improvements ought to have some longer enjoyment of the fruit of their labours than was conceded to them under the existing law. The fourteen years ran out before they could get remunerated for their labours. Literary persons had an interest in their works for life, and their representatives had one for seven years after the death of the authors—in any case, forty-two years certain. Why should not the same rule hold good in the case of inventions? (applause). This must be attended to in any improvement that might be made in the Patent Laws. But the great and the pressing thing to do was to simplify the law, to make the process of obtaining patents as inexpensive as possible, and to insure the indefeasibility of patents when once granted (applause). He would not detain the meeting longer. He could not resist the temptation of that opportunity to raise his voice on behalf of their efforts to improve the Patent Laws, and to bring before them the parts of those laws which he thought required amendment (applause). Having done so, he begged now to introduce to the meeting Mr. Hume Williams, who had kindly consented to deliver the inaugural address, and whose remarks on the subject were sure to be able, interesting, and to the purpose. (The chairman resumed his seat amid general plaudits.)

Mr. Hume Williams then delivered the address "On the Present State of the Patent Question, and the Operations and Objects of the Inventors' Institute." The address was extempore. The learned gentleman said that in yielding to the request of the Council of the Institute to make a few observations in connection with the inauguration of the ninth session of the Institute, he undertook the task with a deep sense of responsibility, for he could not disguise from himself the fact that the position of the Patent Laws at present was most critical. When he looked back upon the operations of this Institute during the past nine years, and noticed and recalled to mind how many eminent men had taken part in the proceedings of the Institute or sympathised with them, he felt he had a right to say, on the part of the Council, that now, when they had noticed that the subject was about to receive the attention of the Legislature, they had indeed arrived at a critical moment (applause). Had they met for the purpose of inaugurating an exclusively scientific institution, he might have yielded himself to the inducement of addressing himself to the many subjects of the very highest interest which were now engaging the attention of the scientific world. He might have referred to the many triumphs of engineering skill which met their view everywhere, and have descanted on subjects which were rapidly becoming great public questions—such as that of the water supply of the metropolis, to which that eminent engineer and member of the Council of the Institute, Mr. Hemans, had devoted so much attention; to the sanitary requirements of towns, and the economical treatment of their sewage—the application of chemical processes to agriculture—the tunnelling of mountains—the traversing of continents by canals and railways—and many others of the same kind; but he felt that the members of this Institute—supplied as they were with such an organ as that of the Scientific Review—had had each of these subjects sufficiently brought under their notice from time to time. He had therefore thought it right to address himself entirely to the Inventors' Institute as an institute, and to confine himself to the special purposes for which it was designed, and the grounds upon which it was at this moment peculiarly entitled to a wide and generous support from the public. He need not recall the very critical circumstances which gave rise to the organisation of this Institute. He need not remind the members who were connected with the Institute from its commencement that, when it was intimated by gentlemen of great Parliamentary name and position that it was their intention to bring in a Bill having for its object the destruction of property in inventions, and the deprivation of inventors' legitimate reward for important improvements, some united and strong action among inventors was deemed necessary, and that an agitation sprang up of which this Institution was the result. He was happy to say that this movement had been confined to no one class or rank of society. They had had some of the most important men in the country for their chairmen—from his Grace the Duke of Manchester downwards. Among men of science they had had chairmen from the late Sir David Brewster downwards—a name which was familiar throughout the whole of Europe. He was glad to see that the working men had assumed a good position in the Institute, and that they displayed much interest in its operations. The consequence of all this was, the results and conclusions at which this Institute had arrived had commended themselves to the Legislature, and there was reason that they would have a beneficial effect upon any amendment that was to be made in the Patent Laws. It was important that they should remember that the Inventors' Institute had now assumed a new position. It had been urged by those who desired to abolish patents that they were an undue restriction on the operations of trade, that they gave to some men too much of an advantage over their fellows, and that they had in them something oppressive and exceptional which ought not to be encouraged by the State. Those persons who thought so reasoned upon false premises. To hold such an opinion was to confound patents with monopolies or oppressive taxes, and to forget the essential differences of separation—namely, that one was a compulsory charge, while the other was a voluntary one, to which they willingly submitted for the sake of some particular advantage. It was now proposed by Mr. Macfie that certain State rewards should be offered for improvements in the arts, and that these afterwards become free public property. All experience was against such a policy as this, because there was no instance in which a really valuable invention had been adequately rewarded by the Crown (hear), and he turned with feelings of shame to the spectacle of the widows and orphans whose fathers had given their best services to their country, and had reaped no reward. The Inventors' Institute was, then, called into existence by the exigencies of the occasion. The Council of the Institute had taken the initiative in the matter, and throughout the country an agitation had commenced with a view to protect those whose interests needed protection. He believed that the Inventors' Institute and its Council had acted throughout in a spirit of complete disinterestedness, and one specially directed towards the advantage of the working classes. The main objects of the Institute

(*Continued on Page* 10.)

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LIST OF PATENTS.—Next month we purpose giving an abbreviated List of Appplications for Patents in the SCIENTIFIC REVIEW. We trust this will be found useful by readers.

THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON.

ESTABLISHED 1ST MAY, 1862.

Past President:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868.

Present President:

LORD RICHARD GROSVENOR, M.P.

MEETINGS DURING THE PRESENT MONTH.

THURSDAY 4th. BANISTER FLETCHER, Esq., M.I.B.A., on Improvements in Buildings.
THURSDAY 18th.—Report of the Patent Law Committee.

R. MARSDEN LATHAM, *Secretary.*

Members whose subscriptions are now due will please to forward the same to the Collector, Mr G. A. Stretton, 4, St. Martin's Place, Trafalgar Square, London.

Monthly Notices.

Inventors' Institute Dinner—Technical Education—London International Exhibition—Typhoid Fever and House Drainage—Patent Self-Acting Ventilation and Regulating Apparatus Company.

FOR us the great event of the month just passed is the dinner of the members and friends of the Inventors' Institute, and the inaugural meeting of its Ninth Session, full reports of which will be found in another column. They were great successes, and we augur much good to the inventors' cause and prosperity to the association from this demonstration of strength and unity on the part of inventors.

The Institute has likewise taken up in earnest with the question of Technical Education, which Mr. F. W. Campin and Mr. Latham did so much in former days to urge upon its attention.

On this subject we are pleased to state that the matter is growing into an important topic in the City, several companies, such as the Painters', the Plasterers', the Joiners', the Armourers', and Braziers' Companies, and notably, as we reported in our November issue, the Turners' Company, have taken up with the movement. The Committee of Liverymen, to which the Institute's Council members, Mr. F. W. Campin and Mr. Davidson, belong, have likewise given the subject their attention, resolving at their last meeting that a conference should be sought for with certain of the City Guilds, in order that some plan of conjoint action might be at once instituted; and with the view of helping forward the matter, Mr. Digby Seymour, Q.C., Liveryman of the Plumbers' Company, was elected on the Committee. We hoped, by favour of Mr. Geo. Saywell, a well-known member of the Painters' Company, to have been enabled to supply more detailed information on this subject, but we have not been able to do so in our present number.

We notice in the daily journals that our old friend, Henry Cole, C.B., and his coadjutors in the management of the Kensington—or, as it is officially termed, London International Exhibition—are raising quite a storm of antagonism on the part of the West-end shopkeepers, on the ground that the Exhibition is, in consequence of arrangements entered into with foreign exhibitors, to be made a huge bazaar of. It is a great pity the Kensington Exhibition party could not let well alone, and not attempt to ride the exhibition system to death.

The lamentable case of his Royal Highness the Prince of Wales has caused much attention to be given to the subject of the propagation of typhoid fever, and to house drainage and sewerage. On the subject of house drainage, "T.W.P.," writing in the *Times*, advocates the adoption of the following simple arrangements, which are very much like what we have often recommended to be used. The only addition that seems necessary appears to be that the outside box into which the house-drain discharges itself should be of the syphon trap kind; and if the drainage could be made to pass through some deodorising and disinfecting material placed in the box (which material should be changed from time to time), a plan as nearly perfect as could be hoped for would be attained. We give "T.W.P.'s" communication *in extenso*. It is as follows:—

"There is a point in house drainage which seems to be generally overlooked, viz., the upward rush of foul air into the house through the scullery sink-pipe every time that water is poured down the sink.

"The sink-trap may be perfect in keeping down the enemy while all is at rest, but when the drain is being used, with only the common arrangement, as surely as water goes down so surely the foul air and elastic gases spring upwards. The former and the latter change places, nay, worse, for where the gas is pressing and ready to blow, probably several gallons of it may blow out in exchange for one gallon of water. The accumulated time during which this interchange of bad for worse occurs during one day in a large household is very serious, witness the evidence of one's sense of smell after a dinner party, when the scullery in the basement is in full activity.

"I have tried a simple cure and found it perfectly efficacious—viz., to disconnect my sink-pipe from the sewer as follows:—I have an open metal box, holding two or three gallons, at the ground level, two or three feet below the sink, and immediately outside my scullery wall, with a grating or other loose perforated cover over the top (for appearance sake). Into the bottom of this box is fitted the pipe, properly trapped, leading to the sewer; and a short leaden pipe, with wide open outlet, connects the sink grating and trap with the box, discharging into the top of it the water from the sink very freely and quickly. This pipe is but three feet long, so that the air is carried down easily in front of the water, but any way the air in this pipe has little or no harm in it, for the foul spirit which leaps from its sewer-prison when the down-rush of water gives it the chance to scuffle its way through, flies into the outer air, and not into my house. And now the sink-smell which used to be my abomination is no longer known.

"Where the box is inapplicable a wide tall pipe or panel might be used, and a modification of the same theory is already in use in the air-pipe now occasionally, but too seldom, carried to the house-top from the closet drain.

"I have adopted for my bath-room outflow the same kind of precaution, by discharging the waste water into a large open spout-head, thus securing a complete atmospheric disconnection, and the cure there is complete also."

We have received a prospectus of a Patent Self-Acting Ventilation and Regulating Apparatus Company, which, it is stated, "ensures pure, perfect, and constant ventilation without draft; combined with equalised temperature in buildings of every description, from a palace to a greenhouse." Stevenson, Welsh & Hope, Inventors and Patentees. Chief Offices, 26, Lord Street, Liverpool.

Every sanitary improvement is of so much moment that we hope this undertaking will receive the encouragement it merits.

INVENTORS' INSTITUTE.

(Continued from Page 8.)

had been to preserve to its owner property that the mind had created, such as had been applied to machinery to the great advantage of our manufacturing wealth, and to develope the inventive powers of the people, on which so much of the wealth and the power of England depended (applause). The Council were glad to see that their efforts had been so far uniformly successful. Leading members of the legal profession—some of whom had been law-officers of the Crown, and more than one of whom were now on the Bench—had given the Council their support, and they had promises of assistance from other gentlemen of the highest positions. This fact was a sufficient answer to the allegation that the principle of patents was unjust. The question of patents had become in a great measure an artisan's question, because, from the improvement in machinery, from the value of capital, from the increase of wages of late years, the artisan had become a highly-educated experimentalist, who brought his knowledge and his genius to bear upon his daily avocations, and who had thereby become of great advantage to his employer. The Inventors' Institute was daily consulted by artisans living in various parts of the country, who came forward to offer valuable suggestions respecting the machinery they supervise, which suggestions they considered would be important improvements, and which they were to make generally known, provided that they had some guarantee that they would not lose the benefit of them That was a practical answer to those who were in the habit of saying that patents were a bar to improvements. The workers in the manufacturing districts had assumed a different position from that which they occupied some years ago. They were receiving high wages and holding responsible positions They were practically a new power, in whose hands was placed the mainspring of the future legislation of this country. It was, therefore, all the more important that they should be made to feel that the law of England protected their just interests. In his opinion, it was impossible for anyone to justly complain of the money realised by successful improvers, since there was no compulsion put upon anyone to make use of improvements. What more equitable arrangement could be proposed than that the remuneration given for an improvement should be paid by those who wish to take advantage of it? As to the money which the Government awarded for secret inventions, it was humiliating to think that the members of the Legislature or persons in authority should have been betrayed into the absurdities which their published reports on the subject disclosed (hear) There were other subjects which also came under the notice of the Inventors' Institute. There was no doubt that any legislation directed to the benefit of the inventor or the manufacturer must assume quite a different phase from that which characterised it some years ago. It was not for the members of this Institute to criticise those who had taken part in the various organisations which had sprung up from time to time, and which had produced far from the best results; but they might say that an Institute such as theirs, having the confidence of the intelligent artisan, and having the confidence also of the manufacturer, must become an instrument of great good and great usefulness. He believed he was right in saying that their scientific referees were largely consulted throughout the country, and that the Council of the Institute might yet acquire a proud position in their relation between scientific employers and their employed (hear, hear) But in order to do that they must enlarge the sphere of their operations. The Institute might become a valuable arbitrator in scientific and patent questions between employers and employed, and inventors and capitalists. For that reason alone it was most desirable that the sphere of their usefulness should be enlarged. Hitherto this Institution had been self-supporting. They had received neither Government grants nor grants from those the saving of whose property was in the issue, and to whom had accrued in consequence vast and untold wealth Those persons had hitherto held aloof Probably this was because in the beginning the Institute was limited to a small area The objects of the association had, however, commended themselves to the working classes generally. This was proved by the fact that they had branch associations in every part of the United Kingdom. They had been largely supported throughout the country, because their Institute rested upon the broad foundation of the general artisan classes, and because the benefits the Institute sought to confer were of a character to commend themselves to those classes They had a great basis in almost every manufacturing town of note throughout the country. But something more was needed More activity and material aid were required. Looking to the vast amount of correspondence which had to be carried on in their relations with the working classes and the other classes who had an interest in the question, it was evident that it would be well, previous to the Patent Law question coming before Parliament, that aid should be obtained from the manufacturers whose interests were so much involved in the question It was only by these means that they could be placed in a position to enable them to settle the question of the Patent Law conclusively and satisfactorily (hear, hear). That the Institute had been acting disinterestedly there was abundant evidence The suggestions which they had made before the Royal Commission on the subject was appointed had been adopted in almost the very words in which those suggestions were made All they wanted were just laws wisely administered, the expenses in connection with those laws curtailed as far as possible, and the rights of invention protected The Institute trusted to see before long all these achieved and in force in an effective way (hear, hear) He hoped to see a Bill introduced during the next session of Parliament which would embody the points to which he had just referred There was no longer any doubt that the country was dissatisfied with the present state of things, and that it had made up its mind to put an end to the existence of the unjust system which had been allowed to prevail too long (hear, hear) On behalf of the Council and the organisation generally, he said that they were opposed to all monopolies and to the continued existence of all abuses They had no selfish objects to gain. They had nothing to derive from the movement but the consciousness that they were labouring for the mechanical educated classes of the country, the real scientific workmen whose avocations prevented their attending to their own interests One of their great objects was to preserve property in mind as opposed to property in capital, and to settle the questions which these two properties involve on a sure and certain basis. He trusted that the Institute would continue to maintain that high character which it had already achieved for itself during the ensuing session of Parliament, which, it was said, would take in hand the Patent Law questions, that in the approaching struggle the voice of the Institute would be heard, that it would be confirmed and strengthened by the voice of the artisans of the whole country, and that those who derived such substantial advantages from its efforts would come forward and throw the shield of their position and strength round their weaker brethren, and contribute from their great wealth to the accomplishment of the objects of the Institute (applause). With the success they had already achieved in making their objects known and gaining so many adherents, they thought that they need not fear that energy and perseverance will ere long make them victorious in the battle for the protection of property in the invention of the mind (loud applause, during which Mr. Williams resumed his seat).

Captain SELWYN rose for the purpose of performing what was to him a ... and in the enjoyment of which he was certain every person in the meeting would participate. He first of all desired to express the great satisfaction he felt at the important accession of strength the Institute had received in the person of their new Chairman (applause). Sir Antonio Brady had become well and honourably known in connection with an important department of the working strength of the Government. Some time ago that gentleman retired from the post with honours, and had commenced to take an important part in the active duties appertaining to the public and the distinguished men of our country (applause). Their Chairman was now what was called in Somersetshire one of the "iron working men" of the age. The gallant captain trusted that the Chairman would long be able to take an iron part in the public affairs of the country, and that he would also enable the Institute to, as they say in Somerset, "put their foot down square" on the matters they had taken in hand. He had been lately through the United States of America, and he could assure the meeting that he was no unobservant visitor whilst there The conclusion he had arrived at was that the race was going against the inventors of England, and that it would go altogether if they could not do something to encourage and to induce activity and progress. The pleasurable duty he had to perform was to propose a vote of thanks to Sir Antonio Brady for having presided, and for the manner in which he had spoken on the subject in which they were all so interested, and indicated what their future course would be (applause). He had also the equally pleasing duty of proposing a vote of thanks to Mr. Williams for the admirable address which he had just delivered (renewed applause).

Mr. G. W. HEMANS, C.E., had great pleasure in seconding the proposition He had listened with much pleasure to the address which Mr. Williams had delivered. His advice was that the three simple points which Mr. Williams had touched upon—namely, the establishment of just laws, the curtailment of expenses, and protection for the rights of inventors—should be carefully watched by the Council of the Institute. Have these three things accomplished, and the question was set at rest It had been said often that it was difficult to improve the Patent Laws The only reforms really necessary were those so forcibly and well put before the meeting by Mr Williams. (hear, hear).

Mr F. W. CAMPIN supported the proposition. As a member of the committee of the Institute for watching the proceedings in the Commons, he had had some useful experience. He had found that what the Institute most required was to be strengthened by the active assistance of some gentlemen upon whom the public might rely. Such a gentleman was Sir Antonio Brady, upon whose accession to the Institute as Chairman of the Council Mr. Campin set a high value. They already had found Sir Antonio to be of great assistance to them in carrying out the work of the Institute (applause). With such aid Mr. Campin was sanguine that the Institute would do even more in the future than it had done in the past. Mr. Williams had touched upon the importance and the necessity of the Institute having additional funds. This was an important point which he hoped all interested in the movement would bear in mind and practically remember (hear). He was certain that they all felt equally obliged and indebted to Mr. Williams for the address he had delivered, and to the Chairman for his presidency and the telling and suitable observations he had made in opening the proceedings. No words of his were, therefore, necessary to recommend the motion to their acceptance. He would, before sitting down, say a word or two for the SCIENTIFIC REVIEW. It was their own organ, and he should like to see it more used by the members individually for communications on scientific and practical questions. They should write for it; they should speak for it; they should advertise in it; in fact, do everything to give it tone and

position, for let them remember the Press was the Fourth Estate, the most potent of all (applause).

The proposition having been agreed to by **acclamation,**

The Chairman again rose. He said that he could not adequately express the pleasure it gave him in occupying the position which he now held. He did not think Captain Selwyn had in the least exaggerated the interest which he (the Chairman) took in such a movement as this. If anything could enhance the pleasure he felt at presiding at this meeting, it was to listen to the wonderfully exhaustive and interesting speech which was made by Mr. Williams. He (the Chairman) had in the beginning promised the meeting a good treat in the shape of an inaugural address. He did not think that he could accuse himself of having disappointed them (applause).

THE OPENING DINNER.

This took place at St. James's Hall, in the evening of the same day as the inaugural meeting of the session.

The stewards were :—Sir Antonio Brady, **Knt.,** chairman of the Council of the Institute; the Right Hon. the Earl of Caithness, vice-president of the Institute; Sir William Fairbairn, Bart., C.E., LL.D., F.R.S., vice-president of the Institute, A. J. Beresford Hope, Esq., D.C.L., vice-president of the Institute; his Grace the Duke of Manchester, vice-president of the Institute, W. H. Barlow, Esq., C.E., F.R.S., member of the Council of the Institute; Henry Bessemer, Esq., C.E., member of the Council of the Institute, Benjamin Burleigh, Esq., C.E., member of the Council of the Institute, F. W. Campin, Esq., member of the Council of the Institute; C. G. Carttar, Esq., auditor and member of the Council of the Institute, H. C. Coulthard, Esq., member of the Council of the Institute, Sir William Fothergill Cooke, member of the Council of the Institute, Samuel Courtauld, Esq., member of the Council of the Institute, George Willoughby Hemans, Esq., C.E., member of the Council of the Institute; W. T. Henley, Esq., C.E., member of the Council of the Institute; M. M. Harris, Esq., member of the Council of the Institute; R. Marsden Latham, Esq., B.L., secretary of the Institute, A. J. Murray, Esq., member of the Council of the Institute; J. J. Parkes, Esq., member of the Council of the Institute, Frederick Ransome, Esq., member of the Council of the Institute, J. J. Russell, Esq., member of the Council of the Institute; Capt. J. H. Selwyn, R.N., member of the Council of the Institute; C. W. Siemens, Esq., C.E., F.R.S., member of the Council of the Institute, W. Smart, Esq., member of the Council of the Institute; F. H. Varley, Esq., C.E., vice-chairman of the Executive of the Council, Robert Whieble, Esq., member of the Council of the Institute, Hume Williams, Esq., B.L., chairman of the Executive of the Council; W. N. Wilson, Esq., member of the Council of the Institute, **Marshall M. Harris, secretary of the Dinner Committee.**

The dinner was well served, and gave general satisfaction. The following is the bill of fare:—Soups: Clear turtle, hare, spring. Fish: Cod and oyster sauce, turbot and lobster sauce, fillets of soles, Maître d'Hôtel, fried smelts. Entrees: Petits Pâtés à la Princesse, Côtelettes de Mouton aux Macedoine, Ris de Veau à la Financière. Joints. Saddle of mutton, roast chickens, boiled turkey and celery sauce, ham, tongue. Game: Pheasants, plovers, widgeon. Dressed vegetables: Potatoes sauté, cauliflowers au Gratin, mushrooms Bordelaise. Sweets: Chartreuse jelly, Victoria jelly, Noyeau creams, petits Bouchées Vanille, noisettes Parisiennes, Gateaux Genoises Glacés au Kirsch, Baba au Rhum, poudin Glacé à la St. Jacques. Dessert.

Louis Beck's band was in attendance, and played a choice selection of music during the evening. Mr. J. Ford was the toastmaster.

The Chairman said grace both before and after dinner. As soon as the dessert was laid, the chairman proceeded to give the usual loyal toasts. Feeling and believing that he was in the confidence of his loyal fellow countrymen, he rose with pleasure for the purpose of proposing a toast which had never yet failed in this country to receive the loyal response of every Englishman to whom it was ever submitted (cheers). He believed that there never was a time in which this toast was more acceptable to Englishmen than the present (hear, hear). They lived in no common time. They were surrounded by enemies; but, thank God, the heart of the English nation still beats true. If they looked around the world they would see that England had been blessed above all nations. If they took a retrospect of the affairs of this and other nations during the reign of her Majesty they would see that no nation had more reason to be thankful for the blessings she enjoyed than England. Public opinion was the law of England (cheers), and public opinion was never exercised under a more beneficent Sovereign than the present (cheers). Our beloved Queen was now in great distress of mind. She still lamented the loss of her good husband, to whom this country was so much indebted, and she was now in attendance at the side of the sick bed of her eldest son, the heir to the throne of these realms. May God bless and support her in her troubles, and may He in due time restore to health the Prince on whom so much depends! No country on the face of the earth had made so much progress during the past thirty years in the arts of peace as England. He wished he could add the arts of war, because the arts of war were preservative of the arts of peace (hear, hear). At the same time he would say, without the fear of contradiction, that the arts of peace are the greatest protection against the awful calamities of war, provided the cultivation of the arts of peace are pretty general. May this country long continue to foster and endeavour to spread broadcast the arts of peace! (cheers). But in the face of what other countries were doing it was well at the same time that we should bring to bear upon our army and navy the greatest possible amount of energy, science, and ability, so as to keep us in readiness for any emergency that might arise. Our people must be educated in technical knowledge if we would keep our own among nations (hear, hear). We must preserve to our inventors means for the promotion of those useful arts in which they are engaged, and secure to them those rewards for the improvements which their industry and their talents created (hear, hear). He believed that there was no matter of greater importance to a nation than to foster and encourage this inventive genius of its people. It was, he considered, the bounden duty of the Government to do this, and the best means of doing so was to grant rewards for and protect inventions. It was very little consequence what Government was in power so long as we had a stable Government, and a Government prepared to act in accordance with the wishes of the people. The people of this country made the Government. The people had also the making of the laws in their own hands, and he was certain that they would ere long take care that their inventions were protected. As he had before said, we lived under a benign Sovereign, and we had been blessed more than any other nation had been blessed. He said therefore, without fear of contradiction, that the man who would attempt to upset our constitutional institutions was not only a traitor, but a fool (applause). He called upon **the assemblage to drink to her Majesty's health. He prayed that the nation would long be reigned over by her Majesty, whose virtues and wisdom had so much adorned the high position which she had occupied for so many years (cheers).** He included in the toast both **the Prince and the** Princess of Wales (cheers). **It had been his privilege to meet the Princess of Wales when her Royal Highness was very young, and for some years past all England had come to know her** and admire her. He **believed that a more amiable and lovely person** did not exist. **Her Royal Highness was now** in deep affliction. **May God avert what she feared, and may she prove as great a blessing** to this country as her Royal Mother-in-law had proved **herself to be!** (cheers).

The toast **was drunk with much enthusiasm.**

The Chairman **thought that the next toast** he had to propose **was one which would commend** itself to all **present. It was the two** Houses of Parliament **(cheers). He was sorry** that no peer was present **to speak for the House** of Lords. To the peers of **England we owed** much of our liberties and **privileges—to the** barons of Runnymede this **country owed a deep** debt of gratitude (cheers). **There was, however,** a member of the House **of Commons** present who would respond to **the toast. He** alluded to Mr. Charley (cheers). All **esteemed** the privilege which the people **of this country** had of **sending representatives to the House of** Commons. He thanked God that **we had such** a privilege. **But it was a great advantage** and blessing also that we **had an Upper** House to keep a check **upon hasty legislation.** Fault had been found **with the House of Lords** because of its hereditary **character; but it** should be remembered **that it was annually,** and almost daily, **recruited from the people** (cheers). Notwithstanding **all that had been** said against the House of **Lords it was still** considered the highest honour which **could be** conferred upon a man to be sent to the Upper House.

The toast having been **drunk with all due** honours,

Mr. Charley, M.P., rose to respond, and the hon. and learned **gentleman was loudly** cheered. He regretted that the Duke of Manchester was not present to return thanks for the House of Lords, but as the two **Houses** were so interwoven with each other, as a member of the Lower House he had no hesitation in speaking to the toast. **In an age** when one of the branches of the **Legislature** was threatened with destruction **it was not** surprising to find the Patent Laws threatened with destruction also. **His** hon. friend **Mr.** Macfie had threatened to do away with the Patent Laws. It was, however, a consolation to know that there was a great difference between the appointment of a select committee of the House of Commons and the destruction of the particular thing the committee was appointed to inquire into. It did not follow that because a select committee of the House of Commons was appointed the Patent Laws would be abolished. He understood that a Bill was to have been laid before the committee, but that it had been thought better to lay the Bill before the House of Commons first. It seemed that Mr. Macfie wanted some money—some £200,000. He (Mr. Charley) hoped that the money for the proposed purchasing up of patents would not be made up by means of a new tax by Mr. Lowe. The abolition of monarchy had been also advocated. Some persons were *fools* enough to think that by doing away with the monarchy of this country we should get rid of paying taxes. It did not follow that the abolition of monarchy would be attended with the abolition of taxation. During the cab strike of 1853 we were told that if we reduced the tax on cabs we should soon have plenty of good cabs in the streets of London. The tax was reduced, yet we know that London continues to be troubled with bad cabs. The fact was that the cabmen had pocketed the difference instead of devoting it to the improvement of their cabs. It would be the same with those who desired the abolition of the monarchy. Any money that might be saved thereby would be pocketed by **the** gentlemen who brought about the change, **and** the burthens on the general ratepayers **would** be as heavy, if not heavier, than at **present** (hear, hear). He had been told **that this** Institution was connected with the **working** classes. He vouched for that. **It was as the** representative of working men **that** he was present at the dinner that evening, and as such he resented the existence of a law under which it was possible for them to be deprived of the advantages of the **creation** of their own **brains. As** he **understood the work of the** society, it was not to **destroy** but to reform

(hear, hear). He trusted that they would address themselves earnestly to the measures by means of which an alteration in the Patent Laws would be accomplished. His friend Mr. Murray had told him that he had to expend £900 on account of an invention before he could get even a hearing in court. That was a disgrace to the laws of such a country as England (hear, hear). He thought that they might trust to the future and the wisdom of the Legislature to reform such a state of things as this. How was it possible for a poor working man to establish and uphold his rights in the face of such difficulties? (hear, hear). As a representative of the working classes in the House of Commons he returned thanks for the toast with which his name had been coupled (cheers).

THE CHAIRMAN said that his next toast was "The Army, Navy, and Volunteers." This was also a toast which he believed would commend itself to all present. The navy was our grand line of defence. He believed, with regard to the other public services, that if ever England had to defend herself on her own soil the army and volunteers would give a good account of any enemy who would have the hardihood to attempt to invade us (hear, hear). There were no pressed men in the British service. They were one and all willing, and he hoped would be found ready whenever any emergency arose to protect the shores of England and their homes and firesides (cheers). The army of this country had before now attempted to do great things, and he believed they were as able as ever to repeat those glorious attempts should occasion arise, and would prove themselves equal to any emergency. The people had lately bought back the army, and it was now the people's army (cheers). He looked upon the army and navy of England as second to no other army and navy in existence. He believed that there still existed sufficient pluck in the navy to secure to England for many a day the character of being the ruler of the waves. He only wished she could manage to rule it more evenly (laughter). He coupled with the toast the names of Mr Josh. Harris, Captain Selwyn, and Mr. Varley, junior.

The toast was enthusiastically honoured.

Mr. J. HARRIS responded for the army. Correctly speaking, he had no actual connection with the army. He was only a volunteer, but he could boast that he was one of the first who enrolled themselves as volunteers. He, however, had a son in the army, so that he had to some extent a connection with the service. He had been an officer in a South American republic. When he came back to this country and saw the wise connection of Church and State, and noticed the many blessings that we enjoyed, he thanked God that he was once more on English ground, and no longer under the flag of republicanism. He attached great value to an institution like this, and he urged upon all who had any interest in inventions to support it by their means. Englishmen did not understand the troubles to which inventors were subject. Few of them knew of the troubles and expenses attendant upon inventions. He trusted that through the instrumentality of this Institute such a state of ignorance would not be of much longer continuance (hear, hear).

Captain SELWYN, R.N., returned thanks for the navy. He remarked that inventors had at all times studied the safety and the convenience of the navy. Hitherto, in nearly all cases of invention, there had been a large amount of difficulty to encounter, inasmuch as those who assumed to invent had but little acquaintanceship with those for whom they invented. This ought not to be. Unfortunately, the navy had suffered a good deal from the many "tin-pot" engineers it had to deal with. Our ships had become horrid monsters, and we had guns which it was totally impossible to handle. This Institute had been condemned by "tin-pot" engineers and pseudo inventors, but about that the members of the Institute need not much care. But still it was a very lamentable state of things that those to whom such important work was entrusted were not men of greater intelligence and ability. He had hopes that in future our inventors would be men of some real knowledge, particularly of forts. There had been an addition of £4,000,000 to our taxes for the construction of vessels whose sole excellence seemed to be to go the bottom upwards (a laugh), and for guns whose only excellences were that the cost of powder for them was greater than the cost of the guns themselves, and they were liable to explosion. When this was found out, then came a general condemnation of them. All this serious loss of time and money was to be attributed to the utter ignorance of those who had charge of such matters, and in the Government not calling to their aid those who could give advice. He hoped there would be more of matter and less of form in future in the drinkings of the toast of the army and navy, and that on such occasions as the present those who could give useful information respecting the two branches of the service would do so, with the ultimate object of improving our facilities for doing the important work connected with the navy more properly than they had hitherto done. It was not unlikely that during the coming session of Parliament we should see such a reversal of some previous decisions respecting the Patent Laws as would have the effect of carrying forward certain improvements which were necessary, and of enabling England to keep herself in the high position among nations which she had so long retained. He believed that England's future race among nations would be a heavily-weighted one, unless she encouraged invention and developed as far as possible the talent of the country (cheers). The navy returned, through him, its hearty thanks for the toast, and trusted that the Institute would continue to go on and prosper (cheers).

Mr. VARLEY, jun., in responding for the Volunteer force, said that he had attended almost every inspection of Volunteers which had taken place, and had paid some attention to the spirit which pervaded the force; and the conclusion he had come to was that if ever an emergency arose they would show themselves ready and able to do their duty. England may have only a small army in comparison with other countries, but he believed that she had in addition a fairly efficient Volunteer force upon which she might well depend. There was a unity of interests between the three services. As had been remarked, the members of the whole three services of this country were volunteers. There was among them all a natural and a steadfast love of country (cheers). On the part of the Volunteers of England he begged to return his very sincere thanks for the compliment paid them that evening.

After some appropriate music,

The CHAIRMAN said the next thing he had to do was to propose what was the toast of the evening—namely, "Success to the Inventors' Institute" (cheers). All those who had the privilege of listening earlier in the day to the address which Mr Hume Williams delivered (cheers) would require no words from him (the Chairman) to make them properly appreciate the toast. It was not necessary for him to say anything in recommendation of the toast to those persons. If he remembered rightly, it was Wellington who first showed us that much of the greatness of this country depended upon our inventors. He remembered Mr. Connolly, a working man, saying, some two or three years ago, that this being a small country, it could not well compete with the larger countries of Europe unless our people were educated (hear, hear). Nothing need be said to add to the truthfulness and importance of that sentiment. England was a small country, and it was only by taking advantage of the assistance which education afforded that we could hold our own among nations (hear, hear). Otherwise we shall most assuredly dwindle down into the position of a little Italian republic. There was no doubt the Anglo-Saxon race was in the ascendant. It would be to him a most deplorable misfortune if anything should stop the indomitable perseverance and the strivings of the inventive genius of the Anglo-Saxon race. He believed we had raw material of the very best description. We had an intelligent artisan class, capable of producing great things if properly trained. With these materials, if we only had a fair start, he did not care for German, Jew, or Gentile (cheers and laughter). He believed that the Anglo-Saxon was ready to keep pace with all competitors; but the Anglo-Saxon must be educated, and there was no fear of the recurrence of such painful spectacles as their being beaten by foreigners in their own staples and in their own markets (cheers). He believed that the Institution whose anniversary they were celebrating that night was doing a great work. He also believed that if the reforms proposed by this society were carried out, England need not fear being able to hold her own among nations, and retaining the unrivalled position she had so long occupied (cheers). In 1851, when the first International Exhibition was held, we found that we could hold our own against any comers. In 1862, the year of the Second Exhibition, we found that the Germans had set their minds upon the establishment of technical colleges; and we have since seen with what important and valuable results. The fact was, if we wanted to keep in the race of nations at the present day, we must educate (hear, hear). We were taught in our youth to believe that one Englishman was worth two Frenchmen. (A Voice: Three.) Well, three. When we found the Germans rivalling us in as many as a hundred of what we used to consider our own articles, and that they were even now able to undersell us in those goods, it was nearly time that we should be on the alert. If there was one staple upon which this country had depended more than another, it was iron. It had late greatly distressed him to find that many of our railway companies were using German iron and steel. He attributed this disgraceful state of things to the lack of education in this country. He would take another instance. There was the woollen manufacture. We were at one time, *par excellence*, one of the greatest woollen manufacturers in the world. The manufacturers of Germany had educated their artisans to such a pitch that they were positively competing with us in our own markets. This rivalry was to be controverted only by the aid of technical education. It was therefore the bounden duty of England to give to her working classes the same facilities and advantages which the foreign working people possessed. As soon as we do so we need not fear the competition of any nation. For these reasons he had come to the conclusion that the Inventors' Institute was a patriotic organisation. He had therefore great pleasure in proposing success to the Institute. (cheers).

The toast was drunk amid general acclamation.

Mr. H. WILLIAMS acknowledged, on behalf of the Institute, the enthusiastic manner in which the toast was honoured. He considered that the Inventors' Institute was an organisation which commended itself to the best and the dearest sympathies of the people of England (hear, hear). It was formed on no narrow basis—it was dedicated to the protection of no narrow interests. It was no political institution. In all that appertained to the rights of labour and to the claims of those who have property in inventions, it was essentially liberal, and in all that appertained to the accomplishment of high aims by honourable means it was highly conservative. This was the opinion he had formed of the Institute after nine years' acquaintanceship with it. Mr. Williams again referred to the interest which leading members of the legal profession had shown in the Institute, in somewhat similar terms to those he used when delivering the inaugural address of the session, and went on to remark that an institution of this kind was based upon the best sympathies and purest feelings of the country. He trusted that the efforts of the Institute would meet with

an encouraging response throughout the country, and that by a united effort they would ere long be able to congratulate themselves on the accomplishment of the just objects they had in view (hear, hear). The great hope of the members of the Institute was that their efforts would eventuate in the amelioration of the social condition of all concerned in the movement, and in improving the position of their country and establishing that position on a firm basis (hear, hear). All that the Institute wanted were just laws justly administered, and an extension to every artisan of a protection for the property which his inventive genius may create. He was confident that the more closely the action of the Institute was investigated the more the public would be convinced of its worth, and the more thoroughly would the artisans believe that they may safely and satisfactorily make it a means of redress for any grievances they may labour under. He looked upon the Institute as second to none in scientific attainments. The more the objects of the society were made known and the more its operations were extended, the better it would be understood and the more widely would it be appreciated (cheers).

Mr. R. Rapier observed that invention is the handmaid of prosperity to every civilised nation, and it was the duty of every civilised Government to encourage invention in every way. This, unfortunately, was not the case. That was just what they had to complain of. The army had been revolutionised, and the navy had been drowned He supposed the next thing that would be done would be to abolish the Church. The Inventors' Institute, in common with other societies, was sick of politics. All they simply went for was that it was the duty of all Governments to support art, science, and invention (hear, hear, and cheers). The great misfortune of the present day in England was that there was a great dearth of scientific labour (hear, hear). It was notorious that Government departments were the slowest of all classes of persons to encourage or adopt any new improvement. The consequence was that the English engineers and scientific men were not in advance of the French or the Americans. The fact was we were hoodwinking ourselves. It was all nonsense to suppose that we were superior in this respect to our French neighbours or our American cousins. The sooner we got rid of the notion and looked the real fact clearly in the face the better (hear, hear). In his opinion we could not be anything if we were not practical. The practical course for this Institution to take was to at once represent to the Government and the country that the inventors of England had grievances to complain of, and to insist on their right as Englishmen to protection and justice (cheers). The inventors of England must trust to themselves They must frame a Bill of their own, and see to its introduction into Parliament. They must not trust the Government. There seemed to be no use in it. They must go before Parliament independently, and on the principle of give and take (hear, hear, and cheers).

Mr. J. J. Parkes proposed "The Inventors of the Country." He trusted that there would be no lack of gratitude among the inventors of England for the services which this Institute had already rendered them, and that they would support it in every way in their power. The way he looked at the matter was simply this—the inventor was an industrious man, and he ought to be protected and justly treated by the laws. At present he was not so treated (hear, hear).

The toast was warmly responded to.

The Chairman next gave "The Council of the Institute and the Officers," connected with the name of Mr. Hemans (cheers). The Chairman remarked that the Institute would not be as successful as it had been but for its Council and officers (cheers). If he mistook not, Mr. Hemans was son of the great poetess who delighted the hours of our youth (cheers). The Chairman called upon Captain Selwyn and Mr. Harris, who were mainly instrumental to the banquet that evening, to also respond to the toast (cheers).

Mr. Hemans, who was loudly cheered on rising, said he was inclined to exclaim with Mark Anthony, "I am no orator." He thought that there were symptoms of the Institute becoming great and important He believed that it would become both one and the other if the Council and the society got proper support.

Captain Selwyn also briefly responded.

Mr. M. Harris in responding observed, that although he was proud to own himself a native-born Englishman, he had passed nearly all his life in the United States, and he was bound to say that in respect to Inventions and the Patent Laws the Americans were ahead of the English; but he hoped to see this country speedily reverse the position of affairs.

The Chairman next gave "The Patent Law Committee." He said that this committee was of the greatest possible value to the Institute, for on it depended almost entirely their action with regard to the amendment of the law which was so much needed, and which they all so much desired He coupled the toast with the names of Mr. Campin and Mr. Murray (cheers). Mr. Campin and Mr. Latham (the secretary) were the principal persons concerned in drawing up the Invention Right Bill, which would be submitted to Parliament—(cheers)—and Mr. Murray was a practical worker for Parliamentary reform.

The toast was honoured with much applause.

Mr. Campin, on rising, was greeted with much enthusiasm. He explained that the business of the committee was to watch any proceedings in Parliament which affected the interests of inventors. His friend Mr. Latham (cheers), who was about as energetic as anybody, and himself, had often gone down to the committee-rooms of the House for this purpose, and had exercised their best judgment and energy in the interests of the friends and members of the Institute, and in the interests of inventors generally (cheers). He thought he might fairly boast that through the committee of the Institute the question of the Patent Laws had been better ventilated than they otherwise would have been (hear, hear) He had often felt that it was a great pity there were so few persons having a practical acquaintanceship with such questions who had seats in the House of Commons. By means of the presence of such persons great mistakes which were now seldom canvassed until some great national damage was done could be set right in a few minutes, and serious consequences to the country might be avoided (hear). The duty of the committee was not a very pleasing one, for it mainly consisted in sitting still and listening to the enunciation of false statements and absurd crochets, without being allowed to contradict or correct them. They had not, however, shrank from their work on that account. They had endeavoured to do their best, and he was glad to find their conduct had met with the approval of so important and influential an assembly as that which be had the honour to address. He regretted to say that there had been too many witnesses examined whose opinions were of no value. He did not desire to say anything against Mr. Grove, the lately appointed judge, but he could not help remarking that that learned gentleman's evidence on the Patent Laws was utterly unworthy of his great reputation. The Master of the Rolls had also given very objectionable evidence. Why that learned gentleman was called as a witness Mr. Campin could not understand. He had no practical acquaintance with the subject, and the sum total of his evidence amounted to this that he found by his experience as a Chancery judge that patent causes were very difficult and troublesome to deal with, and he thought therefore patents had better be abolished. After the Master of the Rolls came Sir Roundell Palmer. Everybody knew that Sir Roundell wanted to get rid of the Patent Laws altogether, so that his evidence was a foregone conclusion. It might therefore be said that Mr. Bessemer and Mr. Nasmyth were the only persons who gave really practical and truthful evidence. But the character of the evidence was not the only thing they had to complain of. They had also just cause for finding fault with the composition of the committee before whom the evidence was taken. Most of the members of it were manufacturers who were not favourably disposed towards the inventors. That was not fair (hear.) The inventors had only a limited number of friends to rely upon. Past experience had shown that if the Institute was determined to do something more than had been done, it must have more funds. It must do more in the way of printing and publishing their proceedings, and in making known all over the country what they had done and what they contemplated doing (hear). What was most needed was a special fund to be devoted to the making known of the proceedings and the action of the Institute, both in Parliament and out of Parliament (hear.) Their organ, The Scientific Review, should be more widely circulated, so that the information it contained should be made as generally known as possible (hear). With these observations he begged to return thanks for the Patent Law Committee.

Mr. Murray concurred in the views expressed by Mr. Campin, and added his thanks for the honour they had done him by coupling his name with this toast.

The Chairman next gave "The Press." It was acknowledged by Mr. Mackie, of the *Standard* newspaper.

Sir W. F. Cooke, one of the inventors of the great telegraphic system of England, proposed "The Chairman," and it was greeted with rounds of cheers.

The Chairman responded in a few words.

Mr. Campin gave "Mr. Latham, the Secretary of the Institute," amid general acclamation.

The Chairman took the liberty of observing, out of course, that he did not transgress the truth when he said that Mr. Latham was the life and the soul of the Institute: that much of the interests of the Institute depended upon him; and that he had at all times proved himself to be a downright good and genuine Englishman (great cheering).

Mr. Latham was very warmly received on rising to respond. He said that he was sincerely thankful for the kind reception that had been accorded to the toast. He had always endeavoured to do his duty towards the Inventors' Institute, and that was all the credit he could take to himself for anything he had done. He was proud to find that the Institute could now boast of nearly 700 *bonâ fide* members to do battle in the cause of the inventors of this country (cheers). That, he thought, was a matter for much congratulation (hear, hear). On the cause depended, in his opinion, the future of England. Without the inventors our manufacturers would not be able to keep pace with the manufacturers and the workshops of the world (hear, hear). The Institute wanted England to make use of every passing advantage, so as to successfully meet competition of modern times. He hoped that the Legislature would take the matter in hand, and place the inventors of England in a favourable position in relation to their compeers of the continents of Europe and America (hear, hear). He was glad to see a member of Parliament present—(cheers)—and to think that they might depend upon his aid. The Institute had been successful in getting people to work together. They could now boast of a solid phalanx devoted to their cause. Among that phalanx were men who belonged to the Royal Society of England and to the other great scientific bodies of the country. The Institute could also boast of such men as Mr. Hemans—(cheers)—and Sir W. F. Cooke, the practical inventor of telegraphs, one of the greatest discoveries of modern times—an invention which had added millions of money to the wealth of England (cheers). There was also Mr. Henry Bessemer—(cheers)—who, unfortunately, was

prevented from attending that evening. Indeed all the members of the Institute were practical workers—were men who had done a great deal to promote progress in several ways, and to help England to stand in the forefront in any competition in which she may become engaged. But they must not keep secret the fact that to prosecute to a successful issue all they aimed at, they stood in need of encouragement and of material aid in the shape of increased funds (cheers).

This concluded the toasts. The company did not separate till near midnight.

At the members' meeting, held 7th Dec 1871, the subject for the evening was "Technical Education," when J. Scott Russell, Esq., C.E., presided, and in opening the proceedings remarked that technical education seemed to him a very fitting subject for the Inventors' Institute to discuss, seeing that the grand result of the labour of the inventor was to improve the condition of the world. Speaking as an inventor, there could be no doubt that scientific knowledge was of the greatest possible importance to the whole class. Although it had been his good fortune to have the advantage of a sound education of a wide range, yet withal he had never found he possessed too much scientific knowledge. The old plan of trial and error, which was adopted by very many inventors and industrial pioneers, was a very dangerous one, it entailed unnecessary expense, and was fraught with numerous inconveniences. He once knew a clever man who wanted to invent a new railway appliance, and having the advantage of a rich company to back him, was enabled to go on trying and failing, trying and failing, till he had devised a thing which was really good, and would probably pay handsomely; but, in the meanwhile, many valuable years of that man's life had been engaged in doing things which the possession of more scientific knowledge in a technical form would have rendered unnecessary. With these remarks he would introduce the reader of the paper, Dr. J. Mill, who had been for some time past engaged in promoting a national system of technical education.

Dr. Mill said he would not attempt to impress the meeting with the importance of technical education, which he doubted not they all admitted, but would seek to show them how a national system of technical education could be practically carried out. Our educational systems, he said, have hitherto been almost universally confined to teaching the classics and high mathematics. But what this nation really wanted was an education that would render a man better able to exercise his calling with advantage, and enable him to take up his position in life with credit. He considered that the reason why we were surrounded by so much pauperism and crime was that the masses were unable to earn their daily bread because of the want of a suitable education. Employment was often offered to men which required some little industrial skill, and yet no men could be found except those who could do nothing but the coarsest kind of work. No importance had ever been given to education in practical science. Although we had academical degrees for the divine and the doctor, we had none for scientific artisans and operatives. The great point, however, was to get money for the establishment of a national system of technical education, and on this point he would suggest that there still exist obsolete charities, the funds of which could be applied to technical education, and that Greenwich Hospital could be readily made applicable as a technical university. But the great want was suitable teachers, and after that want was supplied the whole educational system of the country must be reformed. Perhaps something like Froebel's system of the Kindergarten, which was based on knowledge of drawing and geometry, reading and writing being progressive steps very far on, would be found a necessity in the future. He would put this as a question for the day: is it not possible to so educate the masses that a great number should be able to do something well, some able to do something exceedingly well? Dr. Mill concluded by referring to the great advantage the world has ever experienced from the labours of inventors, and urged that those labours would be lightened and rendered more advantageous to the community by the dissemination of technical knowledge.

Mr. Paterson suggested that Dr. Mill should give a definite statement of the particulars of his scheme for carrying out the objects that he had referred to.

Mr. Morfeshead, as a working man, thought it was absolutely necessary to establish a technical university, and so far he agreed with Dr. Mill. He had been in communication with several organisations of working men—the Workmens' Technical Committee, the Delegates' Invention Right Committee, and others—and the conclusion he had formed was that a great national system ought to be established which should comprise a metropolitan and also local universities; and that to a certain extent the elementary schools and endowed grammar schools should adopt a technical curriculum rather than confine their teaching to mere literary and classical knowledge. Further, that rewards, such as honorary degrees and travelling scholarships, should be awarded. As to appropriating charitable funds to this purpose, there must be a good deal of consideration given to that matter before any such proposition could be entertained. He thought, however, that the surplus Patent Office fund might be applied to promote technical education, and that the trade guilds, such as the rich City companies ought to do something to support it.

Mr. Paterson thought that the system of Froebel ought to be duly considered before anything else, because it appeared to lay at the root of the matter.

Mr. Savage, being well acquainted with Birmingham, knew the great necessity of technical education that existed in that district. He would recommend free libraries, with technical schools attached. He thought that what was done at the Workmen's International Exhibition, 1870, with which he was connected, especially as regarded the placarding of the names of workman producers on their works, and the legislative measure of special protection for the exhibitors, were points to be imitated in any scheme for advancing technical education.

Mr. Campin said he had, as all members of the Institute were aware, been working in this matter for some time past, especially in regard to its connection with the City guilds, and he would submit that those bodies should be called upon to afford pecuniary and moral aid in the establishment of a national system of technical education.

Sir Antonio Brady, as Chairman of the Council of the Inventors' Institute, felt great pleasure in finding himself surrounded by so many friends belonging to the working classes who had responded to the invitation of the Council to come and take part in the proceedings of the evening. It was a practical refutation of the sneer which some people had given utterance to, that the working classes—the men who would be more immediately benefited by technical education—took no interest in the matter. For his part he would say that working men had evinced great interest in the movement he had set on foot in the East-end of London, which resulted in the East-end Museum being founded, with promises of ample Government support; and he saw no reason why that museum should not become an important technical college. And if the Inventors' Institute and the working men would only unite and give their earnest support to the establishment of an efficient system of national education, he would pledge himself to bear his part in the great work, and he felt no hesitation in saying that he thought he could manage to pin the Government in such a way as would ensure that considerable funds would be forthcoming when wanted; but, as the Chancellor of the Exchequer (Mr. Lowe) was by no means friendly to any money being voted for the object, nothing could be obtained except by liberal use of "pressure from without."

Mr. Johnson rose to say that he entirely dissented from the views of the other speakers. The working classes would obtain no benefit from technical education unless many other questions were first settled.

The Chairman remarked that, however wishful he and other gentlemen present might be to engage in other good works of social importance, they must deal with one thing at a time, and technical education was the one for the present evening, and was quite large enough to engage their attention for the time being; and as they had now arrived at a late hour, and many other gentlemen wished to speak and Dr. Mill had still to reply, he thought that the adjournment of the subject would be desirable.

This being advocated by Mr. Broadhurst and Mr Dixon Stansby, it was moved by Mr. R. M. Latham, the secretary, and seconded by Mr. J. Robert Taylor, that the further discussion of the subject be resumed on Thursday, the 21st December, which was carried unanimously.

Plan submitted by a Committee of Working Men (L.R.L.), for National Technical Education.

Your Committee, in presenting this report, consider the following propositions as essential for securing the objects sought to be achieved:—

1. That there should be founded a central institution for the purpose of finishing the training and education of teachers, lecturers, and professors of technical science, entitled the National Trades' University.

2. That in each of the great manufacturing centres of the country the National Trades' University should be supplemented by local universities, which in teaching, while embracing all branches of technical science, should direct attention to the special industrial requirements of the locality wherein the university may be situated.

3. That in every locality of given area and population national technical schools should be established, where also the peculiar requirements of the districts in regard to their manufactures should be especially provided for in teaching.

4. That the Government Education Department be solicited to technicalise the curriculum of education in the secondary or grammar schools which come under the Endowed Schools Act, 1869, in order that they may be made useful to the artizan classes.

5. That school-boards be recommended to adopt in all primary schools under the Act of 1870 a system of elementary education in accord with the requirements of trades in the districts resided in by the scholars.

Management.

The governing power of the National Trades' University should, in the first instance, devolve upon the Education Department of the Privy Council until brought into working order, when its regular governing body should be a periodically appointed board, elected by and from all holding a degree or distinction of merit in such National Trades' University.

The management of local universities should be also invested in a board, having two-thirds of its members elected by the ratepayers of the district, and the remaining third appointed by the governing body of the National Trades' University.

The technical schools should be placed under the control of the school-boards of their districts.

Rewards of Merit and Powers of Governing Bodies.

The National Trades' University should grant degrees and diplomas for special attain-

ments, and have the appointment to scholarships and fellowships. It should also have the power to grant special foreign travelling scholarships, when earned by the efficiency of pupils, in order that the schools of industry and centres of manufacture of other countries may be visited and inspected for the further improvement of such pupils; and the National Trades' University should generally oversee the trade-and-art education of the country.

The local university boards should have the power of granting as rewards of merit a certain number of free admissions to the National Trades' University. Also, home travelling scholarships, so that pupils may have the advantage of observing the operations of other schools and seats of manufacture. It should also be empowered to recommend to the General Trades' University Board a limited number of pupils for foreign travelling scholarships.

To the primary technical schools the attendance should be made compulsory, but under the control of the district school-board as to fees, which it should have the power of remitting in instances of necessity; and in a stated number of meritorious cases it should also have the privilege of granting free admissions to the local university.

General Recommendations as to Rules of Management.

The schools and universities should be furnished according to special wants with workshops, laboratories, and other requisite appliances for operations and experiments.

That the teachers of either schools or universities should be appointed, in consequence of special knowledge as to the requirements of the trade in the locality of such schools or universities, and the workshops and laboratories should be established with a like regard to the said requirements.

That all professorships, lectureships, or offices of emolument should be the reward of merit only, and bestowed upon artizans in so far as practicable.

That a staff of popular lecturers, members of the National Trades' University, should be appointed for the purpose of instructing the adult population in scientific and technical information.

That mechanics' institutions, athenæums, and other public educational buildings should be, as far as possible, utilised for lectures and so forth.

Funds suggested for the Support of these Institutions.

The National Trades' University.—Government endowment. The surplus patent funds, now amounting to over £80,000 per annum, and contributions from the City guilds and public subscriptions.

Local Universities.—By district educational endowments, Government educational grants, and by county rates.

Primary schools to be supported as the unsectarian elementary schools now are, namely, by school fees, capitation grants, and local rates.

The Committee would finally recommend that the Government should give the National Trades' University the power of appointing to foreign diplomatic stations certified workingmen to act as sentinels of labour, for the purpose of communicating intelligence to the central board as to trade movements and industrial operations in other countries.

Latest Discoveries and New Inventions.

Coal Cutting.—Joseph Rothery and Andrew Rothery, both of Waterloo Main Colliery, Leeds, in the county of York, engineers, have just specified a patent for improvements in machinery or apparatus for cutting coal, stone, and other minerals—one important object of the invention being the cutting of a much narrower groove than has heretofore been found practicable, by continuous revolving or rotatory cutters, whereby the power required is considerably reduced, and less waste of the coal or other mineral is effected; facility is also afforded by means of the invention for cutting a groove to any desired depth without reference to the size or diameter of the rotatory cutter employed. At the carriage end of these two steel plates, and situate between the plates themselves, is a chain driving wheel, the periphery of which is recessed to receive some of the links of the chain saw, the said driving wheel being driven either by hand or by power, as is well understood. If desired, the inner carrying pulley, which goes into the groove of the coal, may be dispensed with, and the chain simply passed over a semi-circular guide groove formed in the end of the steel carrying plate or jib, the outer links, or those which come in pairs, being arranged so as to slide along the outer edges of the groove whilst the central links slide along the centre of the groove in the jib. According to another arrangement of cutter, which is also capable of cutting a groove to any desired depth, either vertical or horizontal, without reference to the diameter of the saw, the inventors propose to combine two parallel disc saws or other revolving cutters with a combined driving and cutting chain, situate between the circular saws or cutter discs. The parallel circular saws or cutter discs are made fast to the outer ends of the axis of a chain pulley, which is situate and revolves between them. The inventors have found that circular saws of a diameter from seven to twelve inches will answer well in practice. The said saws are driven or rotated by a pitch chain which passes round the chain pulley above referred to, and this chain carries at suitable intervals clearing tools, such, for example, as short segments of circular saws attached to projecting portions of some of the links, for the purpose of removing or clearing away the core left between the two parallel rotatory saws or cutters. It will thus be seen that this chain performs the double function of rotating the circular saws or cutters, and of clearing out the groove as fast as it is made by them. The chain is actuated either by hand or by power, as is well understood in connection with this class of machinery.

Recent American Patents.

(From the Scientific American).

Steam Generator.—Rus W. Dugan, of Covington, Ky., and Benjamin F. Clark, of Cairo, Ill.—This steam-generator consists in a combination of heating coils and a cylinder, calculated to provide a simple and efficient generator, by which steam can be rapidly and economically made, with no danger of explosion, and with but little wear or injury to the parts, the cylinder being placed outside of the furnace, enclosing the coils in which the steam is generated.

Speculum Attachment.—Jerome D. Bruce, of Newberry, S. C.—This is an improvement in the well-known surgical instrument or appliance known as the speculum, for the examination of the uterus or neck of the womb, and consists in an attachment to the speculum of an elastic tube, so arranged that the tube may be distended after the speculum has been inserted into the vagina, thereby distending the parts and greatly facilitating the examination of the uterus. By means of this tube the operator forces, with his mouth or otherwise, air or liquid into the tube, after the speculum has been inserted into the vagina. By thus distending the vagina and the parts connected with the neck of the uterus, the examination of the latter organ is rendered much more perfect and satisfactory than it has been heretofore.

Extension Clothes-Pole.—James Denton and Whitley Denton, of Amsterdam, N.Y.—To the lower part of a clothes-pole is attached a metallic shoe, the opposite ends of which are turned downward, to enable it to take a firm hold upon the ground and prevent it from slipping, however much the clothes-line may be swung about by the wind. To the upper end of the lower part is attached a band, which is extended upon one side to form a guide and keeper to receive the upper part of the clothes-pole and hold it close to the lower part. To the lower end of the upper part is attached a band, one side of which is extended to form a guide and keeper to receive the lower part and keep the two parts of the pole close together at all times. To lugs formed upon the upper band or keeper are pivoted the ends of a loop or stirrup, through which the upper part of the pole passes, and which catches upon the rack teeth or notches formed upon the outer side of the upper part to support it, however much or little it may be extended. The upper end of the upper part of the clothes-pole is notched to receive the clothes-line, and to the opposite sides of said notched upper end are attached the lower ends of two spring bars, the upper parts of which are bent inward, and their upper ends are bent outward. By this construction the upper end can be conveniently applied to the clothes-line, and when applied will hold the line securely, so that it cannot be blown out, however much it may be blown about by the wind.

Machine for Bending Wood.—Augustus F. Marshall, of Black River, N.Y., has patented a novel machine for bending wood for chairs, &c. It consists in a new arrangement of devices with a former, a metal spring band, and attachments for confining the band to the bar of wood to be bent. The machine is undoubtedly a good one, very strong and compact, and one likely to meet with favour on the part of manufacturers of wooden articles of various kinds.

Low Water Detector.—Mr. Gideon B. Massey, of New York, who has devoted much time to the invention of various appliances calculated to insure greater safety in the use of steam, has lately patented an improvement upon his invention for which letters-patent were granted August 23, 1870. The nature of the improvement cannot be rendered clear without diagrams, but we can assure our readers that the instrument, as now constructed, is an effective device for the purpose intended, sounding an alarm-whistle as soon as the low-water limit is reached. We need not say that we believe these or similar instruments should be placed on every boiler. Our opinions upon this subject are already known to our readers.

Spike Machine.—Frederick J. Kimball, of Philadelphia, Pa.—This machine consists of two roller discs or die-rolls, the dies being so formed in the perimetres of the discs that both the points and heads of the spikes are perfectly shaped, and the spikes cut off of the proper lengths in a single operation, the rod being fed in lengthwise between the rolls. The rolls are actuated by strong and simple mechanism, which need not be described.

Machine for Twisting Yarn.—John Henry Jackson, of Putnam, Conn.—The feature of this invention are the use of spring thread-guides to regulate the yarn as it is fed off the spools, and prevent its too rapid delivery, and also to increase the tension of the same, as may be desired. Also the use of a continuous cord, which is passed over pulleys on the spindles in such a manner that they are simultaneously driven all in one direction.

The Inventors' Patent-right Association, Limited.—This now well-known and ably conducted Association, the prospectus of which appears in the advertising columns, is, as may be seen from the list of recorded specifications, transacting a large patent business. Its organisation for obtaining patents combines so great economy in the charges with sterling efficiency, and its arrangements are so complete for unravelling disputed questions of patent-right, that it is gratifying to find former predictions as to its success fully borne out by the results. Members of the Inventors' Institute, to whom, moreover, it affords special advantages for obtaining and maintaining patent-rights, largely avail themselves of the services of the Association.

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SCIENTIFIC REVIEW,

RECORD OF PROGRESS IN

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AND

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THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

PRESIDENT—LORD RICHARD GROSVENOR, M.P.

THE various efforts which have been made, and the numerous influences now at work to injure, if not to destroy, Patent Rights, the insufficiency of the many well intended, but ill considered, schemes of Patent Law Reform which have from time to time been suggested, and the tendency of which has generally been to prejudice the Inventor, without advantage to the Public, together with the proceedings so essentially involving the interests of Inventors which have already taken place in Parliament, show the necessity of an immediate and active co-operation on the part of those interested in Inventions and in Patent Property, and that an Association for the Protection and Defence of Patent Rights is urgently needed. This Institute has, therefore, been established for the purpose of uniting and organising the influence of Inventors, Patentees, and others. Its objects are:—

1st. To protect Inventors' interests and defend the privilege of obtaining her Majesty's Letters Patent.

2nd. To promote improvements in the Patent Laws.

3rd. To facilitate the diffusion of information with reference to Inventions and other subjects beneficial to Inventors and Patentees.

The qualification for Annual Members of the Institute is a yearly Subscription of One Guinea, and for Life Members a single payment of Ten Guineas.

Persons desirous of becoming members are requested to forward their names and addresses to

R. MARSDEN LATHAM.

Secretary.

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The Scientific Review.

FEBRUARY 1, 1872.

?ALLACIES OF THE EVIDENCE TAKEN ON THE PATENT LAW INQUIRY.—No. IV.

[HE witness who followed Mr. Theodore Aston was another ›f those antagonistic to the rights of inventors, being no less a ›ersonage than Mons. E. Schneider of the Creusot Works, ?rance. He, like Mr. Grove and my Lord Romilly, considered ›atents ought not to be granted for any but what he holds to ›e inventions of *great importance*, and he illustrated his ideas ›y reference to Mr. Bessemer's and Mr. Siemens' inventions in he following way (see Answer to Question 1686, p. 129 of Report):—

"If there were not a few inventions of the rank of the invention f Mr. Bessemer and of the rank of the invention of Mr. Siemens, I hould say that there ought not to be any patents at all. Why hould I name Mr. Bessemer? It is because he has introduced an bsolutely new idea, namely, that of producing a quite exceptional eat by means of the introduction of air and its combination with arbon and silica at the same time that the material submitted to the peration is purified. There is here something which is not within ıe reach of everybody. But when Mr. Bessemer comes to take out patent for pouring out the contents of his vessel by causing it to ırn on pivots, I regard that as a bad joke, because any one of my ngineers who was obliged to make use of this apparatus would of imself invent the means of using it in the easiest possible manner. do not want a genius like that of Mr. Bessemer to invent a quite mple thing like that, and if you give him a patent for that it is ıerely giving him a patent in order to prevent other people from sing his invention. I will say the same of the patent of Mr. Sie- ıens. Mr. Siemens has found out, with the help of M. le Chatelier, French engineer, two things, neither of which was absolutely new, ut which, nevertheless, constitute a real invention. He commences y reducing coal into gas; he burns this gas in the oven; he reheats certain arrangement of brick chambers; and the result is to produce very high temperature which did not previously exist in metal- ırgy, and which was very much required. I should only grant a ıtent for inventions of this nature which attain an object of con- derable importance by means of a combination of processes which absolutely new, and which could not have been obtained in any ther way. It is only in exceptional cases like that that I would rant a patent. Reserving always such exceptional cases, I think ıat in the generality of cases it is not at all necessary to grant ıtents in order to cause progress to be made in industry."

Mons. Schneider afterwards reiterates the well-worn assertion ıat there is a sort of spontaneity of action in public want of ny new thing, and the supply of that new thing by the ıventor; and affirms that it ever will be so, although those 'ho supply such wants may never get anything thereby, and, erhaps, die of starvation—a theory so utterly out of accord 'ith all the other arrangements of human life, that one 'onders that practical business men like Mons. Schneider should utter such arrant nonsense, knowing, as they must, that inventions, before they can become industrially useful, require to be submitted to the test of practice, which in the case of manufacturing improvements can never be effected without the expenditure of considerable capital; and this no sane man will ever expect to be risked in an enterprise of this kind unless some guarantee exists that such expenditure will be recouped, with additional profit. How this is to be effected without legal reservation of proprietary right for a limited time hitherto no man has been able to show. In fact, persons holding this opinion either fence with the question, or, like Mr. Macfie and Sir Roundell Palmer, they opine that it will be to the interest of large manufacturers to make improvements; so that, supposing their theories to be worth what they imagine them to be, even then it is evident that we shall have to depend only upon established manufacturers possessing the resources of capital—the very persons of all others who are the least likely to move out of the beaten track. Truly we cannot help regarding this doctrine of No Patents as one conceived in the interest of great capitalists and manufacturers. In fact, the following question and answer from Mons. Schneider's evidence put forth the whole of the capitalist's case as against the worker (see Question 1702, p. 133):—

"As to clever workmen in manufactories, is it not your opinion that it would be so much the interest of master manufacturers to reward intelligence and invention among their men, that men of invention and practical minds would in the end, and taking a general view, receive greater benefit than that class do at present?—I believe that the manufacturer who does not reward intelligence and any service rendered specially by a workman is very *mal-a-droit*, and does not know his own business. I employ a great many workmen. I had some time ago 13,500, and I have still at this moment nearly 11,500. I am of opinion that they are amongst the most intelligent of workmen, and that they form one of the most disciplined, the best instructed, and the best informed of populations. I have sometimes rewarded some of my people who have rendered me service by the invention of a new process. It is the business of very intelligent and able workmen to find out some new *tour de main*: and it is to the interest of the master of the works to reward such an invention, whether it be by giving a sum of money, or by increasing the daily salary of the workman, because he is more intelligent than another man, or by making him a foreman or even a manager. I have at my works men who are paid very highly, and who have given me a great many of those small inventions, but I have not yet to my knowledge received from them a single invention which is sufficiently characteristic to give it the benefit of a patent."

In fine, it comes to this: Labour, whether mental or physical, is to be the slave of Capital, though Capital *is* advised to be prudent and not press Labour *too hard!*—a doctrine so generally prevalent in France, that it is freely and openly acknowledged. No wonder that country is *par excellence* the land of rabid communism and uncompromising revolution.

Reviews.

Pat Ent Wrinkles. Who.—It.—Them.—Why.—How—and the Cure. Sharp, but True; not Cruel. By Pyro. London: Baillière, Tindall, and Cox, King William-street, Strand.

This is a funny book. It is an attempt to describe in a light and playful manner the kind of life and the sort of experiences which an inventor must expect.

The style the author has adopted is one very difficult to use satisfactorily, and we cannot say that we are altogether pleased with the production before us; nevertheless the subject is one that the public ought to be made acquainted with, and probably they will be better pleased with having it presented to them in the lightsome strain which Pyro adopts.

The following, which we quote from the introduction, will explain the scope and aim of the work:—

Wrinkles are things worth knowing, and no man should be above getting a wrinkle if it is going to make him know a know or two more than he knew before.

Then there is "Who." You would hardly expect I mean this as an individual, but I do! I mean the man many of you know—"the Inventor' he sometimes walks with studious brow, as if he had two half-hundred weights on his mind, and when you meet him as thus, he looks as if his thoughts were far away, or at home upon that last new puzzle presented to his youngest boy (and which he left on the window-sill), and he is wondering how it is to be dissected. You know the class of man I mean—he always has a family as well as a lot of other troubles—the sort of character you fancy has aërial notions, and for all you know, or perhaps care, to the contrary, he lives and feeds on the same light and elastic body, to you he is a mystery, that is if you think of him at all. Well, now, it's about him that I am going to tell you; he is my Mr. "Who," and I think when you become acquainted with him, you will be better satisfied with him, and declare he is not such a flighty fellow as you thought him.

My "It" is the subject of invention, and as I cannot treat that as an individual, I won't attempt to take a liberty; all I will say is, you are very well acquainted with each other, for you see "It" in all your waking moments, and feel the effect of "It" in all you do, or all you have done for you in this happy and blessed state of civilisation. Now, by my "Them" is meant you, and everybody you do know, and everybody you don't know—no matter how many you may know—for by "Them" I mean the public in general. The "Why" is the cause The "How" is the effect produced. The "Cure" is the remedies I shall presume to put forth to meet the difficulties which exist, and in the polishing process I shall use no frictional powder, but try what can be done with *sweet* oil alone—I could use acid and grit, of which I have a vast quantity in store.

Although the subject is as dry as law, I promise faithfully to teach you by experience in the matter, without giving you "Coke upon Lyttleton," "Blackstone's Commentaries," or a nasty, musty-fusty series of Acts of Parliament to wade through (you can go to them afterwards if it suits your taste). I think you will say, "experience makes fools wise," and beats law in the race for knowledge. I shall give you facts, and as much like fiction as possible; but we may as well have a fair understanding at the outset, and that is, that there is no fiction in these pages, for they are all facts.

Now, I feel satisfied I have your full pardon about the question of title-page.

In short, this work may be said to be a jocose description of Laws, Customs, and Manners of yᵉ English in regard to inventors and inventions.

The experiences of the author have brought him alongside various kinds of men, whom he names "Can-Sees," "Can't-Sees," "Won't-Sees," &c. He says further:—

I could extend the series and feel it most painfully while so doing, but I have a fear my readers might tire if I continued, and deem it that I am treating more of men than of matter.

These families I must deem characters, but I cannot leave off without referring to two others whom I have had to deal with, and who cannot be classed with the above, so I must introduce them as—no characters at all—they are people with strange ideas. I really think the simplest way is to let the reader judge of them and the views they hold, as well as the opinions they endeavour to maintain. And to instance a case as against those views and opinions, there are many and able men who take a peculiar tone as regards patent-right, and say that there should be no privilege by patent. Now I think if this is seriously considered, it must be seen these views are very wrong. *For what man would give up his time, expend his money, and this knowingly,* that as soon as he made known his labours to the world, anyone with means could produce the article, gain a profit, and he receive no return for his study and outlay, in fact not even acknowledged? Truly it might be the result of an accident produced at a small cost, or it may have occupied a long period in mastering the details, during which time it has required the whole of a man's energy to overcome the difficulties, and it may be reasonably expected that, meanwhile, money *must* have been spent, let alone the amount a man might have earned in the time had he kept to the beaten path, and not have devoted himself to this task. Ever so good an idea entering a man's mind would cause him to pause, and say, 'Why should I lose my time in this matter? let them do so that have time to spare, the idea is good enough! but not the prospects." I feel that the men holding these opinions of no patent right never could have been inventors themselves, in the strict sense of the word—by this I mean working out ideas, from their first crude form to the finished production.

They may have been purchasers of the ideas of others, after the toil and trouble of working out, and begrudge the money thus paid, and thus become *patentees* by holding the rights.

For I believe if they did but know the care and anxiety necessitated in the working out, whether rich or poor, they would not, and could not hold such opinion.

Again. I have come in contact with men of good standing, and who upon general information have shown sound judgment, holding this opinion—that *Copyright* should be a *property*, but *Patent right should not be a property*. Now this I look upon as adding insult to injury, or using common sense in a very curious manner.

Let us presume a case—a man of large imagination writes a book in which he says, 'among other wise things, that he made a machine with which he visited the moon,' and opened a trade with this world and the inhabitants of that chaos, to the mutual benefit of both orbs (*imaginative, very*). Now this is copyright, and gives a property, to infringe which would be to subject you to the terrors of the law. The expense it has cost this idealist of a gentleman to make this a property has been a few pens, a bottle of ink, the paper for rough draft, and fair copy, the time such as may be expected from one endowed with so vivid an imagination.

This is a property which may get a large sale and profit, if he can get the public equally imaginative *to buy*.

Now we will imagine the man struck with the idea to make and accomplish: he has to do what our imaginary copyright-holder has done—that is, conceive the idea, and put it on paper; thus far they are *equal*, and property holders.

The inventor goes further; he sets to work, and makes drawings of his idea, he makes models of his idea, he produces patterns of his idea, then he makes, or causes to be made, his idea in full size working order, and with this manufactured idea he makes a journey to the moon, brings from there some of the produce, opens up a communication that ultimately forms a large commercial branch of industry. For doing this he is to have no right in his production, only what he can make by the voyage, for anyone else can see his machine, copy it, sell it, or do the journey, and as they have no *back debts* against it as the inventor had in the time occupied to work the idea out, why he may offer better terms to the Moonites, and gain the support of those calm, shining, and distant people. Please excuse this farce! for illustration—here is one who is struck with an idea, and he puts it on paper, and becomes a man of property and fame, according to the public appreciation.

When we read the amount of sensational stuff that gratifies the youth, and in many cases youths of larger growth, of the day, in which if about seven murders, five or six houses on fire, and three or four shipwrecks, any number of runaway horses being stopt at the very exact moment; the finding of the will up an apple tree; the key of the secret case down a well; the return to natural senses of the maniac who attested the marriage ceremony;—this, with the death of one or more of the villains, and the marriage of a few of the good and virtuous *heroes* and *heroines*.

Why this stuff becomes a property, and the world looks upon the producer, him or her, as very great people, and lionise them accordingly; but the inventor of what is a real and practical benefit to his fellow-man, and which has cost him so much more *time*, more *money*, more sound judgment and *observation*, has to give all this up because he went further than imagination; he was foolish enough to go to Practice'

This, I think, is quite a lesson for a man to think over.

Perhaps the most practical part of his book is that which speaks of Patent Agents and Governmental patronisers of Inventors, which is done in this wise —

I feel I should not be doing my duty if I was not to say that in the choice of a Patent Agent something akin to more than caution should be used: for there are those who have fared sumptuously, I may say princely, upon the brains of the inventor; and very many instances are known of men presuming to act for the inventor as his agent, and after they have extracted the whole of the details from their client, conducting his affairs in such a way that the patent is not worth the parchment it is written upon, and the charges made against the inventor so enormous, that they have never been able to clear them, and these sharp gentlemen have made capital out of the perfect scheme by selling the idea to others, and these have *secured* by patent—then, and not till then, has the inventor known the defect in his own specification, and if he has complained of the unthankful manner with which his agent prepared his specification, he has been told, "I acted according to your views; if yours was not perfect it is no fault of mine," and then he has presented to him an enormous bill of charges for fees that staggers him. And thus he retires from the field, seeing he has been duped, befooled, and humbugged. Now, I think it would be well if Patent Agents were somewhat under control by licence, and that if such cases could be brought home, they should receive severe punishment. I am well aware it would be a very difficult task to bring home a case, for the doings with the inventor and the agent are of a secret nature, and the rough draft may be so arranged that it would be such as to justify the defective specification, and the pure idea may be conveyed to the purchaser so as to make his specification correct. This, of course, would be hard to prove, but many cases such as this have occurred, and many is the one that has suffered by it: so, caution. If the laws are not altered, make as many inquiries about your Patent Agent as you would about the firm you were going to send a bale of goods to for the first time; this caution may save you the heartache.

Such is your position. If, as I have said,

you are a rich man, you may get all you look for, which I trust is honour only. If it is money, you may be less fortunate. If you do get money, you will be more fortunate than I and many others have been.

Now, if you are not a rich man, and wish to go through this farce of sheepskins and big seals, you should, upon the first deposit of the five pounds, when application is made for the patent, turn your attention to look for some one of means to join you in the matter, he to find money from this date; you to find means, or make such a bargain as is fair and equitable; for you then get relieved of part of your burthen, and have some one interested in your doings with whom you can confer, and thus grow up together to the knowledge of one another and the matter you are engaged upon; for at whatever stage your invention is worked out to, capitalists, as a rule, will not make any allowances or advances to meet back expenses. Thus it is better to join issue as soon as possible; it is better for both parties, and more likely to end in success.

If your invention is one purely of a Governmental nature, and you have no interest at Court or departments, get an introduction to some well-known man in the service, and make a bargain with him for him to have *all the honour* and *a part* of the money to father the invention (of course he finding money out of pocket for fees and expenses); for you must not be known in it, or you would damage the cause, and the nearer it is to perfection the harder your work if you are known in the matter, and you are not known as one of the service. Caste! caste!! caste!!! I wish it were cast out and merit given where merit is due, for a man that sets out consciously with an invention is only the victim of circumstances, and the instrument used to work out the ideas conveyed to him, and he would be neglecting a duty if he did not perform what his conscience believed to be right.

Now, having shown the way to do the business of how to patent, I leave to your own judgment whether you will undertake the duties yourself or employ a Patent Agent, and which is very advisable; but most certainly see to the searching in the first place *yourself*—you can do it better than anyone else; but in taking the after-steps it is advisable to employ some respectable office, for it is well to remember the old adage, "That a man who is his own lawyer has a fool for his client." The same may be said in many cases by a man being his own Patent Agent.

As far as the law can do anything for inventors, the author recommends the formation of a Court of Patents. Although this suggestion is well worthy of consideration (though it is by no means new), nevertheless it requires grave consideration as to the scope and effect which should be given to the action of such a body as that referred to.

That a Patent Tribunal of a similar kind to that which Pyro recommends should be established the Inventors' Institute and almost everybody who favours Patent reform appear to affirm, but the limits of its functions and action have not obtained a similar concurrence of opinion. His proposal stands thus:—

I now enter upon a task which, I fear, I may not be able to do justice to—that is, to provide a remedy for the difficulties that beset the inventor under the existing system. If I succeed, even to a small extent, in doing so, I shall be content that I have not written these pages in vain. I will consider in the first place the vast sums paid, and the profits, as shown in the transactions under the present state of things. This amount is sufficient large to support a practical body of gentlemen, to form various boards—say, Chemical, Mechanical, and Philosophical; and I would further suggest that it would be advisable to create a Court of Patents, to be presided over by a judge, chosen, for his knowledge of these matters, with a separate jurisdiction. Part of the judge's duty, assisted by the various boards, would be to decide all questions as to infringements, title, and the like. The boards would be *practical* and *scientific* upon all cases arising as to patents; the judge would *administer the law* upon the matter at issue, or the question raised—similar in practice to that of the Admiralty Court, where the judge is often assisted by the elder brethren of the Hon. Board of Trinity, on points of practical experience, as regards collisions at sea and the like, and the damages to be awarded for same. Again, such boards would be able to judge of the merits of inventions, whether or not they would be of use to the nation; and being practical bodies, their opinions would have weight, remove many trials and difficulties that now present themselves to the inventor, and lighten the responsibility resting on the shoulders of the various departments.

With this we conclude our notice of this funny little book, and we can only say that it would not be a bad thing for every inventor to purchase a copy, and after reading it himself lend it to his friends, for it may enlighten them as to the position and prospects of the inventor, and thus do good in more ways than one.

The Royal Institution: Its Founder and its first Professor. By Dr. Bence Jones, Honorary Secretary. London: Longmans, Green, and Co. 1871.

THIS is truly a pleasant and instructive work, being a series of interesting biographical sketches, the first, however—Count Rumford's, who was the founder of the Royal Institution, is not merely a sketch, but a complete history of that Scientific Admirable Crichton.

In the present day, the names and actions of men of the last century seem to be as little known as those of Antediluvians; hence the biography of Count Rumford may perhaps be now accepted as something novel, and therefore—according to modern notions—entertaining. Certainly the life of Count Rumford was no common one, and his labours, as a social and scientific improver, eminently noteworthy.

Benjamin Thompson, the future Count Rumford, was born at his grandfather's farmhouse, Woburn, Massachusetts, March 26, 1753, and the house is, it is said, still to be seen near the meeting house in North Woburn. His father died when he was a year old.

A small inheritance from his grandfather helped to support and to educate the boy. By the law of Massachusetts everyone had a good grammar-school education, and the village school teacher at Woburn was then a graduate of Harvard College and taught a little Latin. From his earliest years the boy was fickle and careless. He neglected regular work, but liked arithmetic. He was full of energy and quick to make what he wanted. When eleven he went to a better school in the neighbouring town of Medford. When thirteen Benjamin Thompson appeared unlikely to make a farmer. He was therefore apprenticed to an importer of British goods and a dealer in everything at Salem, on October 14, 1766. "Instead of watching for customers over the counter, he busied himself with tools and instruments under it." When he could he played his fiddle, and played it well. When only fourteen, his master allowed him to make small ventures in shipping goods that were paid for by a relative. He was clever at drawing and cutting names, and he thought he had "invented a machine for making motion perpetual." When the repeal of the Stamp Act occurred, he blew himself up with fireworks, and was in great danger of death. His master signed the non-importation agreement. Thus his apprentice became useless. When sixteen he returned to his mother. To an elder school-fellow, L. Baldwin, at this time he wrote questions on light, heat, and the wind.

In 1769, when seventeen, he was apprentice and clerk to a drygoods dealer at Boston. There he went to an evening-school to learn French, paying only for the hours he attended.

A note-book made by him about this time still exists. It abounds in caricatures. Has receipts for different fireworks. One of these ends with, "Love is a noble passion of the mind." Contains the sum he paid for learning French and for pew-rent, and the sums gained by cutting and carting firewood for relatives. Instructions for the backsword exercise, with a sketch of two combatants; and later there is an account of "what expense I have been at towards getting an electrical machine," and "an account of what work I have done towards getting an electrical machine."

In the winter of 1770 he was ill for five weeks with fever. Then for eighteen months off and on he boarded with Dr. John Hay, of Woburn, and whilst with him he learned something of anatomy, chemistry, materia medica, surgery, and physic. During the summer, 1771, he went to Cambridge, to attend Mr. Winthrop's lectures on Experimental Philosophy. In the winter of 1771-2 for some weeks he was teaching in a school at Wilmington, and in the spring he taught at Bradford. In the summer he left Dr. Hay for good, because he was asked by Colonel Walker to become the fixed master of a school at Concord, New Hampshire. This place had been called Rumford when it belonged to Essex County, Massachusetts. The name was changed when the disputes as to the county to which it belonged were ended.

The Rev. T. Walker was the first minister of Concord. He was a native of Woburn and connected with the Thompson family. He was the chief man in Concord. His son was a colonel and a lawyer, and his daughter, when about thirty, was married to Colonel Rolfe, who was sixty. She was left a rich widow in two years, and in the middle of the following year Thompson came, as schoolmaster, to Concord. He was not yet quite twenty. His friend Baldwin describes him "as of fine, manly make and figure, nearly six feet high, with handsome features, bright blue eyes and dark auburn hair. His manners were polished and his ways fascinating, and he could make himself agreeable. He had well used his opportunities of culture, so that his knowledge was beyond that of most of those around him, and he was able to give satisfaction as a teacher."

In the country parsonage and at Colonel Walker's house he frequently met Mrs. Rolfe, and he told his friend Professor Pictet that she married him rather than he her. This was about the end of 1772, when he was nearly twenty. He had to teach no more in school. His marriage made him one of the chief men in Concord.

After his marriage he went with his wife to Portsmouth, where she knew Governor Wentworth. "He saw in young Thompson not only the representative of a family already known in the public and social life of his province, but also a man of much promise, one likely to work vigorously in whatever he took up." The Governor soon gave Thompson a commission as major in the second provincial regiment of New Hampshire. The young officer at once became an object of jealousy and ill-will to all the lieutenants and captains of his regiment. The favour of the Governor made all his brother officers his enemies.

His marriage did not materially alter the course of life at first adopted by him, for he occupied himself with farming, scientific pursuits, and experimental researches, except when engaged in military duties.

In the Alienation Act of the Senate of New Hampshire in 1778 he was named among the proscribed; and in 1781, the confiscation papers of his property call him "of Woburn, physician, now an absentee."

When Lord George Germain became one of his Majesty's principal Secretaries of State, November 10, a commission was issued under the great seal "for the restoration of public tranquillity among his Majesty's deluded subjects in the affected colonies." A proclamation said: "Apprised of the fatal consequence of the conduct they had adopted, and seeing the determined spirit of the nation to maintain its constitutional rights, they will avail themselves of the means which the justice and benevolence of the supreme

legislature have held out to them of being restored to the King's grace and peace." This failed utterly, from ignorance of the depth of opposition in the colonies. Boston was evacuated in March, 1776, and Mr. Thompson was sent to England with the news. He was probably thought perfectly qualified to answer; every question relative to his Majesty's service. Cuvier says, "La bonne mine du jeune officier, la netteté et l'étendue des renseignements qu'il donna, prévinrent en sa faveur le secrétaire d'état au département de l'Amérique." His news caused no great distress, and his information must have reassured the minister, for even in June Lord G. Germain and the Prime Minister wrote to General Howe on the good prospect of an end being put to the rebellion in one campaign It was the good news from Canada that helped to deceive them.

Mr. Thompson was taken into Lord George Germain's office, and he was appointed Secretary of the Province of Georgia.

In the autumn of 1777 Thompson was at Bath for his health, drinking the waters. Whilst there he made some experiments on the cohesive strength of different substances. These led to no great results, but he communicated them to Sir Joseph Banks, the new President of the Royal Society.

In 1778 Mr. Thompson was with Lord G. Germain at his house, Stoneland Lodge, Sussex. Whilst there Thompson made experiments on testing gunpowder, and on a new method of determining the velocity of projectiles. The results were sent to the Royal Society, in 1781, and were published at great length in the "Philosophical Transactions." One good observation is now of great interest. "Being much struck with the accidental discovery of the great degree of heat that pieces acquire when they are fired with powder without any bullet, and being desirous of finding out whether it is a circumstance that obtains universally, I was very attentive to the heat of the barrel after each of the succeeding experiments, and I constantly found the heat sensibly greater when the piece was fired with powder only than when the same charge was made to impel one or more bullets."

In order to pursue these experiments he went in 1779, on board of the "Victory," of 110 guns, commanded by his friend Sir Charles Hardy. He passed the whole of the campaign on board of the fleet, and the result of the observations that he then made furnished the materials for a chapter which he contributed to Stalkart's "Treatises on Naval Architecture" He added to it a code of signals for the navy, which was not published.

The Royal Society made him a fellow in 1780, he being then 25 years of age.

Three subsequent years were passed in the execution of the military and civil duties of the offices to which he had been appointed Having attained the position of Colonel, and done much useful service in the British Army in America, he was knighted by George the Third, and received permission to enter into the service of the Bavarian Sovereign.

In this service Sir Benjamin Thompson continued for many of the best years of his life, during which he was occupied in organising the military resources of Bavaria, and in establishing a system of Workshop or Houses of Industry with the view of transforming beggars into industrious useful citizens, all these efforts being accompanied by successful results. Whilst engaged in these important labours Sir B. Thompson did not forget the cause of Science, for in 1786 he communicated in a paper read at the Royal Society an account of his experiments on the relative conducting powers of mercury, water, air, and a torricellian vacuum. He also occupied himself with experiments on measuring, the velocities of cannon bullets by the recoil of the gun. And likewise with experiments as to the intensities of the light emitted by luminous bodies and various other subjects.

In 1791 he was made a Count of the Holy Roman Empire by the Elector of Bavaria, who was at that time one of the Vicars of the Empire, and in the following year his first wife died. About the year 1795 he published a proposal for forming in London a Public Kitchen for feeding the poor, and promoting improvements in the management of heat and saving of fuel, this society was the germ of the Royal Institution.

From 1799 to 1814 Dr. Bence Jones remarks that the History of Count Rumford was chiefly the History of the Royal Institution. In 1804 he embraced a matrimonial alliance with Madame Lavoisier, which does not appear to have led to the happiest results.

The death of Count Rumford took place in 1814

Dr. Young, who, whilst Professor at the Royal Institution, knew Rumford well, said of him in the "Encyclopedia Britannica." "Count Rumford certainly possessed considerable facility of conversation, and there was a very laudable spirit of originality in his views and mode of reasoning, although he had never leisure to acquire profound learning in any department of study. In person he was above the middle size, with a dignified and pleasing expression of countenance and a mildness in his manner and tone of voice. He was ambitious of fame and distinction, and had too great a propensity to dictate without sufficiently regarding the opinions of those who were of equal authority with himself. His mode of life was abstemious, and his health was even supposed to have suffered from too great abstinence, though his regimen was much more the result of medical opinion regarding his health than of his own peculiar taste for temperance."

By his will, of which Lafayette was a witness, he made a bequest to his daughter, and another to Harvard College "for the purpose of founding, under the direction and government of the corporation, overseers, and governors of that university, a new institution and professorship, in order to teach by regular courses of academical and public lectures, accompanied with proper experiments, the utility of the physical and mathematical sciences for the improvement of the useful arts, and for the extension of the industry, prosperity, happiness, and well-being of society."

He left all his military books and papers to the Government of the United States, and the snuff-box given to him by the Emperor of Austria to Baron Delessert, and his gold enamelled watch to his friend Mr. Parker. He thus showed his regard for Davy:

"I give to Sir Humphry Davy, Knight, Professor of Chemistry in the Royal Institution of Great Britain, my plain gold watch, as a token of my esteem.

Madame de Rumford gave up her interest in the lease of the Count's house at Brompton to his daughter, who went to London in May 1815 and lived there for twenty years, during which period she returned to Paris for three years. In 1835 she went to America, and then she returned to Paris until 1844, when she revisited America In the room in which she was born she died, when seventy-eight years of age, December 21, 1852. She left her property chiefly to form the Rolfe and Rumford Asylum for the Poor and Needy at Concord.

The memory of Count Rumford is preserved in Munich by a stone monument in the English Garden, erected by public subscription in 1795, and by a bronze statue placed in 1867 by the present King in the finest street in the city.

In Paris a street once bore his name, and his gravestone in the cemetery at Auteuil is the only material mark of his residence in France.

In America the Rumford medals which he founded, and the institutions he originated, form his enduring monuments.

In England the highest scientific reward which the Royal Society can bestow, and the place where the greatest scientific discoveries of this century have been made, should both in gratitude be inseparably united with the name of Rumford.

Dr. Jones sets out the proposals of Count Rumford for forming the Royal Institution, which state that it was to be a Public Institution.

The two great objects of the Institution being the speedy and general diffusion of the knowledge of all new and useful improvements, in whatever quarter of the world they may originate; and teaching the application of scientific discoveries to the improvement of arts and manufactures in this country, and to the increase of domestic comfort and convenience, these objects will be constantly had in view, not only in the arrangement and execution of the plan, but also in the future management of the Institution.

As much care will be taken to confine the establishment within its proper limits as to place it on a solid foundation, and to render it an ornament to the capital and an honour to the British nation.

We have dwelt so much upon the career of the Count because he is perhaps the least known of all those connected with the Royal Institution. As to the other portions of the book, we shall perhaps give the reader the most correct idea of them by quoting from Dr. Jones' preface to his work.

I have written short accounts of the earliest professors because the spirit that has shown itself in them has up to this time been the life of the institution. Dr. Garnett and Dr. Thomas Young had comparatively little influence there, because the founder took the most active part in the establishment of his Institution; but when Count Rumford and Sir Joseph Banks had left and Mr. Bernard and Sir John Hippesley were the leading managers, Professor Davy gradually became the main supporter of the place, and to him chiefly it owes the form which it now retains.

During the last half-century the name of Faraday has been so blended with that of the Royal Institution that few people know what Davy made it; and fewer still have heard what Rumford at first intended it to be.

The following account will show that the Institution owes its origin entirely to Rumford, and would certainly have failed but for Davy. Moreover, it will be seen that before Faraday came there, it had been the home of Dr. Garnett and of Dr. Thomas Young; Dr. Dalton had lodged and lectured for weeks there; Sydney Smith, Coleridge, Sir James Smith, Dibdin, Dr. Crotch, Campbell, Landseer, Opie, and Flaxman had also lectured there; Sir Joseph Banks and Mr. Cavendish had been managers, and Dr. Wollaston and Dr. Jenner had been members.

I have searched everywhere to find new or forgotten facts about the Institution.

For the sketch of the founder I owe much to the Rev. Dr. G. E. Ellis, of Boston, who has lately written the Life of Rumford for the American Academy of Arts and Sciences. I have found many despatches and letters relating to Rumford in the manuscripts of the American War now in the library of the Royal Institution, and in the unpublished correspondence of Sir Joseph Banks, in the archives of the Foreign Office, and in the State Paper Office.

Not the least strange fact in the history of this original man is that during his life he received no thanks for all that he did for the Royal Institution. Moreover at the present time he is scarcely known as the finder of Davy and the founder of that place where very many of the greatest scientific discoveries of this century have been made.

For the account of the origin and progress of the Institution I have searched the minutes of the meetings of the managers, the proprietors, and the members. I am much indebted to Earl Spencer, who has lent me from the Althorp library a printed copy of the first prospectus of the Royal Institution. This was written by Count Rumford. I have found many forgotten things in the manuscript letters to and from Sir Joseph Banks, to which I have had access by permission of the Knatchbull family; also in a manuscript life of Mr. Webster, the architect of the Royal Institution theatre; and in some letters which

belonged to Mr. Savage, the clerk and first printer at the Institution, and for which I am indebted to his daughters.

For the sketch of the lives of Dr. Garnett and of Dr. Young I have been able to find very little original matter.

For the life of Sir Humphry Davy I have met with some new facts in his laboratory note-books. These books give most of his daily work at the time when he was making his great discoveries regarding chemical electricity, the alkalies, and chlorine. I have also had the use of the notes by Faraday of four of the last lectures given by Davy at the Institution. This is the manuscript volume sent to Davy by Faraday when he asked to be employed at the Institution. It consists of 386 small quarto pages. Davy at this time was thirty-three, and Faraday was twenty-one. The one was full of energy to profit by the excellence he could follow, or to shun the evil he could foresee; the other had long reached the climax of his success by his youthful popularity as a lecturer and his early renown as a discoverer; and was about to make a rich and an unsuitable marriage; and before long was to suffer from the restlessness of the failing health that ended in fatal disease.

Whenever a true comparison between these two nobles of the Institution can be made, it will probably be seen that the genius of Davy has been hid by the perfection of Faraday.

Incomparably superior as Faraday was in unselfishness, exactness, and perseverance, and in many other respects also, yet certainly in originality and in eloquence he was inferior to Davy, and in love of research he was by no means his superior.

Davy, from his earliest energy to his latest feebleness, loved research; and, notwithstanding his marriage, his temper, and his early death, he first gained for the Royal Institution that great reputation for original discovery which has been and is the foundation of its success.

We trust to be able to return to this very interesting book, and present our readers with notices of the lives of the eminent men who have laboured in the Royal Institution.

On the Economical Production of Peat and Peat-Charcoal. — With incidental reference to the processes pursued at the Redmoss Works, Horwich, near Bolton, Lancashire. Liverpool. Peat Engineering and Sewage Filtration Company, Limited, 28, Church Street. 1871.

Peat has so recently received such ample notice in our pages that we do not now deem it necessary to say more than that this pamphlet appears to treat the matter in a brief, though comprehensive way.

The following statements may, however, be of interest to our readers:—

The process of peat-making on the Continent is mostly carried on by hand labour. The peat is either cut in sods of from four to five inches square, and twelve to fifteen inches long, direct out of the bog, and without any further operation dried in the open air; or it is dug anyhow with a common spade, or, as in France, with a tool fixed to a long shaft, cut and raised from under the water, and prepared into a pulp by men tramping it with their feet, after which it is struck into moulds similar to those used in brickmaking, and then laid out to dry.

The first process requires two men, one cutting, the other wheeling the peat to the drying place and spreading it there. An average of 3000 sods per day are cut and laid out in this way, making about ten tons of wet peat.

The second process requires four men; two digging and pulping, one moulding, and one wheeling, &c. In this way 4000 bricks or sods are made daily, corresponding to about twelve tons wet peat.

In the former the daily yield is about five tons per man; in the latter three tons per man. The former, therefore, has the advantage in quantity, but the latter has it in quality; for in the latter the peat, being rendered more dense, equal, and homogeneous, gives an intenser heat, is less liable to break into fragments when dry, and yields when charred a better charcoal. An additional recommendation for the latter process is that it is applicable to almost any bog; whereas the former can be applied only where the bog is sufficiently dry, or where it can be drained so as to leave the part intended for cutting dry. A bog that is full of roots from shrubs or trees—not an unfrequent case—is also inimical to the treatment of the simpler process.

In America machinery has been applied to pulping and moulding the peat, and, as it seems, with good results. A considerable number of machines have been put in operation in different parts of the States. According to the inventor's own data, however, they do not appear on careful consideration to give much better results than hand labour. Nevertheless, in the United States they may answer their purpose better than they would likely do in those countries of Europe where peat is treated in the ways above described. The labour in peat bogs where the peats are made by hand is very hard work, requiring labourers specially trained to it. The labour with the aid of the machine is comparatively easy, and can be done by anyone without previous training. Mr. Leavitt, the inventor, states that his machine works sixty tons of wet peat per day. He gives the number of men required to each operation, from which the aggregate of labourers appears to be thirteen; so that the average production appears to be only four and eight-thirteenths tons per man; thus proving inferior in point of quantity to the average of hand labour according to the first system above described, and in comparison with the second, in which moulded peat is produced by hand labour, and with which accordingly it is fairest to compare it, not yielding sufficiently advantageous results to justify its introduction on this side of the ocean. This conclusion will at once be seen to be warranted when the cost of his machinery and plant (£2000) is taken into consideration, the interest on which, added to the depreciation by wear and tear and cost of fuel (according to his statement, at least five hundredweight of coals per day), considerably outweighs his increase of production beyond that of the hand labour process, in which the capital involved in tools, &c., is next to nothing.

Notwithstanding what must be admitted to be the relative failure, or rather, perhaps, the insufficient success, attending even Mr. Leavitt's machinery, it will soon be made obvious that steam-power *may* be applied in this business with as advantageous results over hand labour as it has been in manufactures of a more delicate kind—with results, in fact, proportionate to the greater cheapness of steam-power *per se*. At the *redmoss* Works, Horwich, this has already been accomplished; and what *remains to* be said in exposition of this subject will involve incidental comparisons of the results there attained with what have followed previous systems, whereby the advantages claimed will be clearly demonstrated.

Four principal operations are necessary to make the leading products of a peat-bog marketable commodities—the digging, or extracting, the macerating and mixing, the drying, and the charring.

Digging, though a simple operation under ordinary circumstances, is not quite so simple when carried on in a bog. The water interferes unless good drainage can be effected, and even then difficulties arise from the want of firmness in the ground. Digging three or four feet down, the sides often give way, and the deeper we go the less able are the sides to resist the pressure from behind. In such cases the peat is often cut out in holes and the water pumped out as the digging goes on; but the waste of bog in this way is very great. In France, Holland, and adjacent countries a system of dredging is carried out which wastes no peat material, and is in every respect preferable, but it is done entirely by hand labour. In the former mode neither labour nor bog land are economised. In the latter bog land is economised, but not labour. The true policy, of course, is economy of both; and this is effected by the machinery employed at the Redmoss Works.

The main object of the book seems to be to point out the advantages of the system adopted at the above works, which is that of Mr. F. Hahn Danchell, the well-known inventor.

(*Continued on page* 29.)

THE LIFEBOAT WORK IN 1871.

During the past twelve months the lifeboats of the National Lifeboat Institution rescued a large number of shipwrecked crews on the coasts of the British Isles. The list makes a total of 658 lives rescued by the lifeboats of the Institution from shipwreck, in addition to thirty-one vessels saved from destruction. During the same period the Lifeboat Institution granted rewards for saving 230 lives by fishing and other boats, making a grand total of 888 lives saved last year mainly through its instrumentality. Altogether the Institution has contributed from its formation to the saving of 20,752 shipwrecked persons, for which services 915 gold and silver medals and £30,673 in money have been given as rewards. When we remember that nearly every life saved by lifeboats has been rescued under perilous circumstances, the crews often incurring much risk and exposure throughout stormy days and nights, it is gratifying to know that not a single life has been lost from the lifeboats of the Institution during the past three years, in which period they have been manned on all occasions, including quarterly exercise, by upwards of 30,000 persons. It is also a remarkable fact that during the past twenty years the Institution has not lost from all causes more than twenty-two persons from its own lifeboats. We might make an interesting narrative of nearly every one of these brief accounts of noble rescue; but our purpose, as an illustration of the character of these services, will be answered by an allusion to the services of the Ramsgate and Broadstairs lifeboats to the barque *Idun*, of Bergen, which was going to pieces on the Goodwin Sands on the 28th March last. After reaching the wreck and taking from her fourteen men, together with the son and daughter of the captain, the boats themselves grounded on the sands, and the boiling surf broke over them. They had to drift to leeward for three hours in order to save themselves; but at last they got the aid of the harbour tug, by which they were taken in tow and saved. Such deeds are quite as gallant as the most brilliant exploits of warfare, and the time will assuredly come when they and those who have promoted their accomplishment will occupy an incomparably higher place in the estimation of mankind. We will only add that contributions are received for the Lifeboat Institute by all the London and country bankers, and by its Secretary, Richard Lewis, Esq., at 14, John Street, Adelphi, London.

The Inventors' Patent-right Association, Limited.—This now well-known and ably conducted Association, the prospectus of which appears in the advertising columns, is, as may be seen from the list of recorded specifications, transacting a large patent business. Its organisation for obtaining patents combines so great economy in the charges with sterling efficiency, and its arrangements are so complete for unravelling disputed questions of patent-right, that it is gratifying to find former predictions as to its success fully borne out by the results. Members of the Inventors' Institute, to whom, moreover, it affords special advantages for obtaining and maintaining patent-rights, largely avail themselves of the services of the Association.

The Inventors' Institute.

TECHNICAL EDUCATION.

DECEMBER 21st, 1871, John Scott Russell, Esq., in the chair. The adjourned discussion was taken on Dr. Mill's paper on "Technical Education."

The Chairman commenced the proceedings by stating that at the last meeting it was resolved that the present adjourned meeting should take place, and, further, the Council of the Institute was then requested to arrange for a joint committee being formed of members of the Institute and the working men who had come to assist in deliberating on the question, which committee should, if possible, report to the present meeting. The committee had been formed, and had appointed him chairman. Several meetings had been held, and certain resolutions had been agreed on, which were as follows:—

1st. RESOLVED,—That Systematic Technical Education for the English people is a necessity; that a grant of one million sterling per annum ought to be made by Parliament for that purpose.

2nd. RESOLVED,—That a Technical University should be established in the Metropolis for the education of heads of trades and professions, and especially for the education of Technical Teachers; and that a grant of £150,000 per annum should be made for that purpose.

3rd. RESOLVED,—That twenty Technical Colleges should be established in the Metropolis and in the large towns, for the education of the people in the scientific principles of their occupations and trades, and also for education in the application of those principles to the uses of their skilled occupations in life—grant, £300,000.

4th. RESOLVED,—That 300 Schools should be established in the smaller towns and villages, in which the elements of science should be taught, the practical arts should be a subject of special training, and the special crafts, trades, and manufactures of the district should be taught—grant, £550,000.

5th. RESOLVED,—That all these local Technical Schools should be subject to local School Boards, specially elected for this purpose, in the same manner as the School Boards are elected for the Elementary Schools.

6th. RESOLVED,—That the great desideratum for these schools is the superior character, talent, and technical experience and practical and manual skill of the men selected for teachers. It is therefore desirable that the payments to teachers from the Government grant should be such as to secure the services of eminent men, without reference to the wealth or poverty of the pupils taught.

7th. RESOLVED,—That the expenses of the *materiel* of local schools should be defrayed by local rates, and that libraries, museums of science, collections of trade patterns, and models of new articles of manufacture be considered as essential parts of the *materiel* of each college and school.

8th. RESOLVED,—That endowments or scholarships should be founded where they are wanted, and appropriated where they are already in existence, to enable students of distinguished character and talent to devote their time to higher technical studies than their own private means would enable them to enjoy; and also to travel and obtain a superior knowledge in the branches of their professions and trades as practised at home and abroad.

9th. RESOLVED,—That Elementary Schools, already provided by law for scholars from the age of six to fourteen, ought not to confine their teaching to reading, writing, and counting; but that the courses of study and training should be directed towards the special education of the children for the trades and occupations of the district in which they live.

10th. RESOLVED,—That evening courses of Technical Education should be given in all the Technical Schools, and that these courses should be as complete as the morning courses.

11th. RESOLVED,—That the technical education of apprentices be made compulsory.

12th. RESOLVED,—That certificates of qualification and competency shall be periodically issued to students in Technical Schools and to apprentices in skilled trades, by competent boards appointed by the Government.

Mr. Scott Russell remarked that it might be as well for him to state that the reason why the large sums named in these resolutions had been deemed necessary was that the new University and Colleges should, both as regards the professors and tutors, and all educational aids, be the very best that could be got. He might add that there was a great question raised in the committee as to whether the lower schools should or should not be placed under the jurisdiction of the School Boards under the Elementary Education Act. Some thought they should be, others thought that there should be special boards and schools, as they considered the present Elementary School Boards were in most instances composed of men who had been sent to them in order to fight the question of sectarian or secular education, and would be found totally incompetent to deal with the question of technical education. In the result the recommendation expressed in the 5th Resolution had been agreed upon. He then moved the adoption of the resolutions. Before resuming his seat he thought it right to say a few words as to the order of the business of the evening, as it might have been expected that Dr. Mill, the reader of the paper at the last meeting, would open the proceedings, but it was considered that more practical work would be got through by taking the resolutions first—then continuing the discussion, and hearing Dr. Mill's reply.

Mr. MOTTERSHEAD seconded the adoption of the report, and in doing so stated that there were some points in the resolutions which he could not altogether agree with. He quite agreed that a National Technical University would be a good thing; but he considered that institution must not merely be one for teaching teachers, as Dr. Mill's plan seemed to contemplate. It was also necessary that it should be empowered to grant degrees to working men of high scientific and technical attainments. He would insist that one great point in technical education, perhaps the greatest, was to establish good lower schools (elementary technical education). In illustration of what he meant he would refer to the technical schools in Ghent, as described by Dr Mill in his work on "Primary, Industrial, and Technical Education." He thought it would be very injudicious to confine the movement to the promotion of a Technical University (loud cheers). In fact, he would frankly state that he had no confidence in any good result accruing, should the movement be carried on with the restricted programme put forth by Dr. Mill (hear).

Capt. MERCIER said that he must be allowed to state, on the part of the committee of the proposed National University for Technical and Industrial Education, that the diploma system as applied to workmen was contemplated as part of the business of such University; although it was possible that this might not be so clearly expressed in the prospectus as it might have been.

Mr. MACKINNON WALBROOK congratulated the committee on the tenor of the resolutions, and expressed a hope that not only would the working men be brought into the movement, but that no political party spirit would be allowed to be imported into it (hear). He thought the meeting would do well to refer this question to the committee of the National Technical University.

Mr. PATERSON decidedly objected to this proposition of Mr. Walbrook's, because he thought it would be too bad that the committee should have their labours quashed by their being handed over to be dealt with by a number of gentlemen who, whatever might be their merits—and he knew personally that some of them were well worthy of every consideration—were nevertheless without that practical acquaintance with the subject which was essential to the success of the movement. As far as he could understand Dr. Mill's propositions, they were restricted to the establishment of a Technical University, and he considered that that alone was next to useless. Moreover, he could not find upon the Board of Dr. Mill's Technical University names of some men of eminence in practical and technical science, without whose aid he thought no such institution would ever be likely to be established. Although he was a strenuous advocate for scientific technical education, for which he had for years past been working with the Workmen's Technical Educational Committee, he felt bound to say a few words on behalf of rule-of-thumb knowledge, for as that really meant the rule of personal practical experience it was not a thing to be despised. As everyone knew, experience, though a hard teacher, was a very efficient one, and the only reason why he thought scientific technical education desirable was not that he hoped it would entirely eliminate the rule-of-thumb element in technical teaching, but because it would lead men to correct rule-of-thumb teaching by the light of science. With regard to the resolutions, he suggested that the words "practical skill" in the 6th Resolution should be altered to "manual skill," and that the words "appointed by the Government" should be expunged from the 12th Resolution.

Dr. MILL did not want to flatter working men, and did not want them to flatter him. He knew well how great intelligence was to be found amongst workmen, but he thought that they must, notwithstanding, look for the co-operation of other classes in any educational work. What he wanted to see was a system of direct practical education so established that it should permeate the whole nation, and the principal thing that was needed to carry this into effect was a good supply of competent teachers. He would say, let us train teachers first; and to this end he advocated the founding of a national university, which might be not merely a teaching body but a licensing body also, capable of issuing certificates of competency to teachers and to workmen. Notwithstanding the remarks made by Mr. Mottershead at the last meeting, he still thought that the funds of obsolete charities might be usefully applied to the establishment of the Technical University. He felt sure that the success of technical teaching depended on the best brains of England being brought to bear upon it.

Mr. ECCARIUS said that, although he should not oppose the resolutions agreed to by the joint committee, he must say that he much preferred the resolutions agreed to by a committee of workmen appointed by the Labour Representation League, an abridgment of which was published in the *Daily Telegraph* of 13th December. [These are the same resolutions as those given *in extenso* at page 14 of our present volume (January number).—ED. SC. REV.] He decidedly objected to any reference of the resolutions to anybody. Let them pass the resolutions, and go to work at once.

Mr. HYDE thought that certificates of competency granted to workmen by a practical board would be of great benefit. He hoped that not only would the resolutions be passed at once, but that they would immediately proceed to select a deputation to wait on the Ministry to get them carried out.

Mr. CAMPIN, as a member of the Inventors' Institute, of the committee of working men, and also as a member of the Committee of the National Technical University, opposed Mr. Walbrook's proposition. If this movement was to prosper, a large organisation must be formed, in which that University, and, if possible, all other organisations for the advancement of technical education, must be active members. He supported the resolutions as they stood, though he hoped that the sums of money, instead of being named, would be left blank.

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THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON.

ESTABLISHED 1ST MAY, 1862.

Past President:

SIR DAVID BREWSTER, K.H., LL.D., F R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868.

Present President:

LORD RICHARD GROSVENOR, M.P.

MEETINGS DURING THE PRESENT MONTH.

THURSDAY 1st.—Adjourned Discussion on Mr. BANISTER FLETCHER'S Paper on Building Improvements.

THURSDAY 15th.—A Paper on Inventions relating to Telegraphy, by F. H. VARLEY, Esq.

THURSDAY 29th.—A Paper on Saving of Life at Sea, by J. B. ROGERS, Esq.

R. MARSDEN LATHAM, *Secretary.*

Members whose subscriptions are now due will please to forward the same to the Collector, Mr. G. A. Stretton, 4, St. Martin's Place, Trafalgar Square, London

Monthly Notices.

Technical Education Movements—Search for Dr. Livingstone—Exhibition of Pottery at Berlin—A Memento of Sir R. Murchison.

DURING the past month considerable progress has been made in the Technical Education movement, as our readers will perceive by reference to another column of our present issue. In addition to that movement, which is one by the Technical University, the members nominated by the Inventors' Institute, and working mens' organisations, all acting conjointly, there have been signs of a movement in the City, the Lord Mayor having on the 10th January convened a special meeting of the City companies at the Mansion House to consider the question. As this meeting was strictly preliminary the press were excluded; but we have been informed that it was agreed to constitute a committee representing the various guilds. We hope that our friend, Mr. John Jones, of the Strand, who is, we understand, a representative of the Turners' Company, will be able to bring this committee to a right understanding of the matter, as we deprecate the adoption of the policy the guilds seem disposed to act upon—that they are themselves quite capable of dealing with the subject, without consulting the various parties who are interested in it, namely, the professional and working men. Whatever the members of these corporations may think, no doubt at all exists amongst those outside them that, if they claim to hold property by reason of the possession of certain charters, it is their bounden duty to do their best to fulfil the requirements of those charters. They cannot expect to have any claim to the protection of the law if they will not fulfil the law; and these are not times when such corporations, *entirely creatures of the law*, will be permitted to set themselves above its plain commands—that they shall guide and promote the maintenance and advancement of the arts and trades whose names they bear. The eating of good dinners and distribution of charitable doles will not satisfy the public; there must be some great purpose of public utility subserved by them, or they cannot count on the support of public opinion. On the other hand, two great works of public importance lie open to them—Technical, or Trade-Science, Education, and the settlement of disputes between masters and workmen—the first being an easy work for them which they can at once enter upon.

It has now been arranged that the search for Dr. Livingstone shall be forthwith prosecuted, under the guidance of the Royal Geographical Society. We note this with much satisfaction. The pioneers of civilised society always deserve to be guarded and watched over, and in any mischance should receive all the aid and assistance that can be afforded them. Moreover, an expedition of this kind cannot fail to enrich science and advance civilisation.

It appears that the specimens of pottery brought together for the London International Exhibition of 1871 are now being exhibited at Berlin, in the Palace Monbejin, and is attracting great attention. Pottery is, doubtless, one of our staples, and is just one of those that ought to make us alive to the claims of Technical Education.

The magnificent avanturine quartz vase, with its pedestal of polished gray porphyry, which was bequeathed by the late Sir Roderick Murchison to the Museum of Practical Geology, in Jermyn Street, has now been placed in that institution. The following description is taken from Bristow's "Glossary of Mineralogy":—"By far the finest specimen of the Siberian variety (of avanturine) in this country is a highly polished vase, four feet high and six feet in circumference, which, with its pedestal of polished gray porphyry, was presented to Sir Roderick I. Murchison, as 'the explorer of the geology of Russia,' by the late Emperor Nicholas I. The prevailing tint of this magnificent work of art is French white or pearl gray, clouded with delicate rose-coloured tints, and it is equally remarkable for the beauty of the material and the elegance of its form as for its excessive rarity; the difficulty of procuring a stone of such large dimensions and of polishing so hard a substance being so great, that only one other similar vase (presented to the late Baron Humboldt, and now in the Royal Museum, Berlin) has been made. The materials of the base and pedestal were obtained in the Kourgon Mountains, in the province of Tomsk, and were cut and polished in Siberia."

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Mr. Broadhurst thought he had been the victim of a great mistake; for when he as a working-man consented at pecuniary loss to serve on the joint committee, he did so thinking that the results of his labours were to be submitted to the present meeting for final resolution to be come to thereon. Now he found that it was proposed to refer the matter to a second board. He protested against such a proposition, and should vote against it. Let us by all means that we can thoroughly technically educate the working men, therefore let us not occupy any more time over resolutions, but get to work at once.

Mr. Dixon Stainsby remarked that he had heard it said that technical education would do little to better the condition of the mass of the working people. This was to his mind a fallacy. More knowledge of the right sort could not fail to improve the condition of the people, and it was knowledge of the right sort that he meant when he spoke in favour of technical education, for he meant learning and science directed to the perfecting and carrying on of the arts of civilised life, not to the promotion of classical and abstruse mathematical lore and abstract science, which was now the prevailing notion of education. Not that he objected to these things as good for some members of the community, but as things not necessary or useful to the great bulk of the people. Even if technical education of this kind did not remove poverty it would still be valuable, for educated poverty was far better than ignorant poverty.

The Chairman said the hour was now late, and he must close the discussion. He would put the resolutions without further comment, for he thought the matter had been thoroughly discussed both by the joint committee and the present meeting. He would ask the meeting not only to pass the resolutions, but to hand them back to the joint committee to take measures for bringing them before the Ministry, as he was informed that the Inventors' Institute did not consider that they would have time to take any active part in the matter, seeing that the Patent Laws would come before Parliament next session, and that subject was for them the paramount one.

The motion was then put and carried, as was also a vote of thanks to the Chairman.

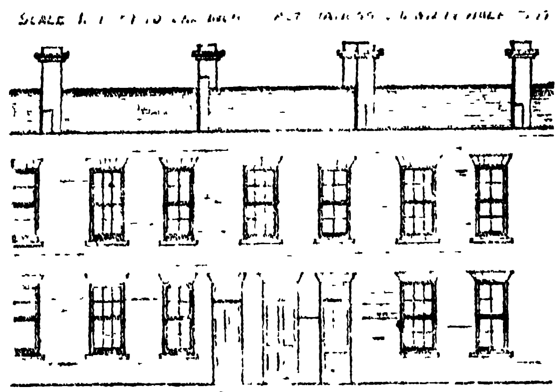
January 4th, 1872, on "Inventions and Patents connected with Buildings," by Banister Fletcher, Esq., M.I.B.A.—Sir Antonio Brady, Chairman of the Council, presiding.

The Chairman, in introducing Mr. Fletcher, remarked that the subject of the paper was one of the most important that could engage the attention of those who took an interest in the sanitary questions of the day. One of the greatest problems we had to solve at the present time was the means of disposing of sewage and making our habitations wholesome. Unfortunately, we had not made such progress in sanitary improvement as might have been expected, and it had been remarked with some show of reason that even now there were, from deficiency of ventilation, many "Black Holes of Calcutta" in our own dwellings. The Chairman then said he would solicit their indulgence for a digression from the business of the evening, by bringing before them the present state and prospects of the question of technical education, which was before them at the last meeting, as the action of the Institute was likely to bear important fruit in the educational institutions of this country: the discussion started by Dr. Mill, secretary to the Technical University Committee, having resulted in the formation of a joint committee of working men and professional persons, for the purpose of devising a scheme for technical education throughout the country which should be not only efficient but acceptable to the working classes, for whose benefit it was intended. Having taken a deep interest in this matter himself, he was glad to have been appointed a member of that committee, and he believed that the resolutions which had been come to would produce a most important amalgamation of interests, and a power of public opinion which he trusted would at no distant day prove irresistible. The result, it was to be hoped, would be that the manufacturing interests of this country would no longer be imperilled by foreigners obtaining a better education than our own artisans. (Applause.) The members of the committee had talked the matter over at his office the other day, and he was happy to say that there was no difference of opinion among the various representatives present. He anticipated that on Saturday they would be able to decide finally as to the course to be pursued. It was proposed to form a deputation, representing all the institutions in the kingdom interested in technical education, and he trusted such a deputation would bring to bear upon the Ministry such an amount of public opinion as should overrule all the parsimonious notions of the present Chancellor of the Exchequer. (Cheers and laughter.) There were certain subjects on which economy became absolutely a crime. (Cheers.) If we could better maintain our trade and commerce by better artisans, the Chancellor of the Exchequer ought to do what he could to help to that result—a result of which the Exchequer would ultimately reap the benefit. (Hear, hear.) We had the best raw material in the world, we were the richest country in the world; and, with proper education, he would back the Anglo-Saxon race against the world. (Cheers.) Without further preface he would introduce Mr. Fletcher to the meeting.

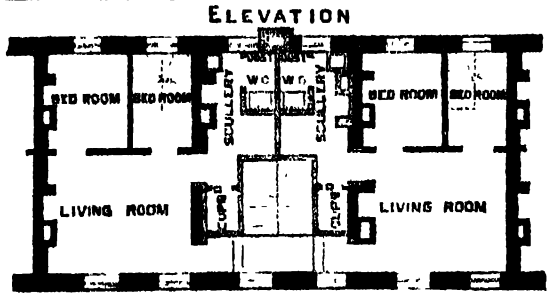
Mr. Fletcher then read the following paper:—My subject this evening is certainly one which must commend itself to all. No one can doubt that the improvement of the dwellings of the noblest or most ignoble, the richest or poorest in the land, is of paramount importance. I at once therefore proceed to consider the details of the subject—why so little has been done generally—then I propose to enter into the various trades, showing what inventions and patents are ready for application to buildings, and will also explain somewhat why so few are produced, and also why those that are should be so little used in modern buildings. First, then, to take the entire building, and work from thence to details. Probably I do it in this form, as it is the usual course pursued in designing our buildings, and as I have in my mind now the injunction so to do by some poet, whose words I remember, though I cannot his name:—

> "Consider what you undertake,
> And analyse it well;
> And ever work from whole to part—
> Grand principle of master art—
> That makes that work to tell."

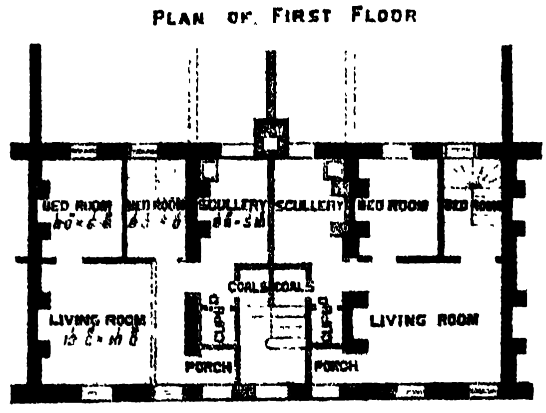
Well, in what does the house of to-day differ from the house built one hundred years ago? I must be understood to mean the usual houses which are being built all over the kingdom, and not as alluding to an exceptional house here or there. It is wise to imitate the prudent tradesmen who just now are "stock-taking", and I am afraid if we take stock, and look upon the houses of to-day and those built some hundred years ago, like that I live in, we must say not merely that our predecessors built much stronger and better houses than we, but also that the inventions and patents, grand as they are, have been so little utilised by builders that even in conveniences the old houses will almost equal the modern. It is strange that this should be so, if one considers the almost appalling number of inventions and patents that yearly are granted. Take, for instance, this country and the average number per annum during the last ten years, a little over 3000 applications were made, and of these more than 2000 were granted. The number applied for last year was 3500, and of these, according to the average, two-thirds would be granted. Now see how slow Old England is. In the United States, for the year ending 30th September, 1871, 19,429 applications for patents were filed in the Patent Office (including re-issues and designs), and as many as 12,900 patents were issued. Yet, again, startling as this is, we find that this number was not so great as that of the preceding year. I notice the fees received during the year by the United States' Patent Office amounted to £671,583. I cannot say what proportion of patents relate to buildings, but one sees from time to time in our professional papers a long list of such patents; so that, no doubt, the thought must arise in the mind of the public, why, then, are not these inventions and patents more used? I will explain. A man, if he can invent something which will enable him to produce cotton a halfpenny a pound cheaper, or some machine which shall be a perfect substitute for hand labour, in some department where the demand is unlimited, may out of such single invention amass a great fortune. The one condition of such success is that the article manufactured shall be in great demand, and that his invention has saved money in its production, or that he shall produce a better article at the old price, or that by his invention useless materials may be made available—for example, much iron is now used by the application of the hot blast that formerly was thrown away; I do not say to the improvement of the iron, but that formerly it could not be used at all. Now you will notice in all cases the basis of large profit is from the extended demand for the article. It is therefore evident that an inventor who turns his attention to



ELEVATION



PLAN OF FIRST FLOOR



PLAN OF GROUND FLOOR

patents in connection with manufactures has the prospect, if he succeeds, of larger profit than he who devotes himself exclusively to patents connected with building. This may account in some measure for the relative small proportion of inventions relating to building. Having, then, shown that the inventive genius is somewhat allured from building patents by the temptation of larger gains, a few words will be well to indicate the difficulties that beset those who, having devoted their time to this class of patents, succeed in producing a valuable and useful one. The architect who is building a house probably goes to see the invention, likes it, thinks he will try it, hesitates, finally probably decides against its employment from fear that it may not be successful. Yet I think little blame can attach to him. If the invention succeeds the merit is the inventor's; if it fails, all the blame falls on him for selecting such a "fandangle, stupid thing." Such will be the language his client may use to him. He therefore has no inducement to recommend a novelty, as it cannot benefit him in his practice, and by so doing he may lose a client. Is it then to be wondered at that we are so conservative in our decisions? *Cui bono*, you may ask, all this explanation if there is no remedy? Well, I have a remedy, and one I think that your Institute should gravely consider. It is the formation of a commission, with unpaid members, who should inquire into patents or inventions when (and not till then) they are being manufactured for sale, and should test them, and should also invite the opinions of all who use them; and these commissioners from time to time should report the result of their investigations. I would base their operations very much on the mode of proceeding adopted by the commissioners of the *Lancet*; and I think my hearers will agree with me these commissioners have done much good. I feel sure that the commissioners I propose would be of great service if the gentlemen were carefully selected. I have said that the houses are built very much as they were years ago. Go into any ordinary house in any of the suburbs of London, and what difference will you find? Why, the house is as nearly as possible a counterpart of any old house, except that it is not so strongly built, shutters are gone, and perhaps instead of the thick sash-bars (which by-the-by some architects are now putting in their new works) large squares of plate-glass. In fact the house, when ready for letting, usually has not one of the modern appliances. This being so, let me consider what a house should be. It should first have a good damp course, to prevent damp arising. Every room should have an air-flue to let the foul air escape, and those rooms where gas is burnt should also be provided with an external ventilator. The pipes from closets should be carried up in an inside recess to prevent frost, and should be accessible by merely opening the wooden covering. The bells should also be so carried up. There should be a hydraulic lift where the house is large. Water, hot and cold, should be on the bedroom floors, and in the lavatories attached to the water-closets. Where cupboards are put they should be fitted having regard to the use they will be put to. For instance, in bedrooms they may [illegible] robes. To see what is being [illegible] ntry, look at the Americans [illegible] houses, not a servant (or [illegible] perhaps call them) wanted upstairs, every room always ready except the dusting; the bed a spring mattress (no making required); a tap to regulate the temperature of the room; washstand with hot and cold water laid thereto, and waste therefrom; so that, positively, while we are quite helpless without our domestic servants, they can do everything upstairs without. Surely the picture I have drawn shows how much we have to do before we can call the Englishman's castle really a home fit for this century. Well may I quote these lines—

> "So slow
> The growth of what is excellent—so hard
> To attain perfection in this nether world."

Mr. Fletcher then proceeded to explain his registered designs for improved dwellings for the industrial classes, and showed how existing dwellings could be adapted so as to meet the requirements of the present day. This latter we illustrate. He takes three small houses of an inferior class of property, with narrow frontages, say, 12' 0" each between the walls, and commences by doing away with the third house, making it into sculleries with kitchen-range (having oven, but not boiler), sink, &c. The front portion is devoted to three lobby entrances, one for each of the ground-floor flats, and the third for the upstairs sets of flats, which are reached thence by stone staircases. The under part of staircase is utilised for coal-closets and lobbies to sculleries. The existing back-room fireplaces and chimney-pieces remain for one scullery, and for the other he builds fireplace as shown. With regard to the existing partitions on ground floor, from front to back of house, at present dividing the front parlour from passage, he removes it entirely, thereby increasing the width of front parlour 3ft. 1in. The back rooms are not touched, except by removing present doorway, and making same to communicate direct with sitting-room. The staircase is removed entirely, and other alterations and adaptations made with respect to doorways and windows, as indicated on the drawings, the existing closets in yard being used by occupiers of ground-floor, whilst new are provided, as shown, for upper floor.

He next proceeded to details, and in comparing granite with marble gave his preference for the former, owing to its richness of colour and greater durability. The specimens of granite consisted of "dark shap," "light shap," and "corn re" Ross of Mull;" and in stating their respective prices, he mentioned that the columns at the Midland Railway terminus, which were "dark shap," and 2ft. 8in. in diameter, were £3 per foot run. Several beautiful specimens of slate were produced, illustrating different imitations of marble, and also some enamelled in plain tints relieved with gold and colours. The different methods of process in working the slate were explained, and prices quoted, which ranged from 2s. 3d. to 3s. 6d. per foot super, where marble would be from 6s. to 9s.; and where the more extensive kinds were used, such as 15s., and jasper 15s. to £1 per foot, the slate was only 3s. to 3s. 6d. When not made to imitate marble, it could be made equally effective by using plain tints and relieving with gold, red, or other colours, and would by this means occupy a position of its own, and from its splendid finish and enduring qualities be much more used. Ransome's patent stone was dealt with, and specimens produced worked with the chisel. This stone has been much used at the St. Thomas's Hospital, where the consoles under main cornice, caps to columns, the pilasters, the balustrades, vases and terminals are composed of it, it being adapted particularly where there is a great repetition of parts, and at, consequently, a great economy. The fact of its being made into grindstones and millstones is some proof of its hardness. It is also being used for the purpose of filters. The various kinds of stone-preserving processes were mentioned, but he would not express any opinion as to their merits. The new Midland terminus is being done with Professor Church's, and also with that of Mr. Ransome. Fire-proof construction was next touched upon, and the prices mentioned of the Dennett system, viz., £4 4s. to £5 5s. per square of 100 feet for model houses, and £5 5s. to £6 10s. for ordinary-roomed houses, inclusive of rolled joists and concrete. Many specimens of moulded bricks were explained, together with the machine for making them. He referred next to concrete buildings, and as this formed an important portion of the paper it was dealt with at some length. Great pains were taken in showing its advantages and disadvantages, as compared with ordinary building materials. In cheapness, strength, and durability, rapidity of construction and economy of space were stated to be amongst the former, whilst its liability to failure from the use of improper materials, or from want of knowledge, comprised the latter. The manner of working the material imposes limits to architectural design and decoration. He objected to the imitations he has seen of stone fronts by concrete, with core of that material to form mouldings, and facing it with Portland cement. Such a method he considered would soon bring concrete building into disrepute. There is little doubt that concrete building, far from being necessarily a "sham," may be made an admirable and useful material, capable of perfectly legitimate treatment with good results. The different kinds of apparatus used in the erection of concrete buildings were then fully gone into, and comparisons drawn between those patented by Messrs. Drake and others. Amongst the peculiar features of concrete building was mentioned that with regard to steps, four of Portland stone pounded to one of cement being the proportion. The cost of these steps is about half that of Portland stone. Seven to one is the usual proportion for general building, but four to one is used for coring out for mouldings, and two to one where the projection is very great. Broken stones and flints take the least cement, ten to one being the proportion. Marlborough College, built under Mr. G. E. Street, has this proportion. An advantage in regard to sanitary arrangement was mentioned, viz., that it will take any number of flues for any purpose anywhere; so solid is the material that flues may come within 3in. of outer face. All fillings into vertical grooves must be avoided, as the swelling of the cement prevents the lifting of the apparatus. The new shaped core to chimneys was explained, which obviates the necessity of making the chimneys tapering, and it was shown that this prevents the series of recesses to catch and hold the soot. In roofing, the thickness of concrete should be 4in. to 6in. and thereon 1in. of asphalte. Specimens of patent zinc were produced by Messrs. Braby, of Euston Road, the cost of which exceeds the ordinary zinc by 15 per cent. only. The gauges usually adopted for roofs, flats, &c., were stated, and in some cases it was shown to be even cheaper than the ordinary zinc. The annual amount of zinc used in 1845 was 5000 tons; in 1860, 25,000 tons; and since then the increase has been even more rapid. The great essential point in laying zinc is to allow it plenty of play for expansion and contraction; and it should not be allowed to come into contact with lead or iron, and any iron framework, screws, nails, &c., should be always galvanised. It was mentioned that the above zinc had been used over the cloisters of Canterbury Cathedral twenty-four years, and had not since cost £5 in repairs. With regard to stable fittings, Mr. Fletcher remarked great praise was due to the energy displayed by the St. Pancras Iron-works Company. He had used their bricks for paving and all their fittings both in Hampshire and in Surrey. The stalls should be quite level, but as at present this cannot be done so as to obtain perfect drainage, they may fall in length from manger 1¾in., and from side to centre ½in. The plainest of fittings are the best. The St. Pancras have the advantage of wrought-iron posts, which are not so liable to break as the cast-iron. A useful invention is a double fastening which falls down each side of stall into a cast-iron receiver, and is noiseless. The three-hole manger is sometimes objected to, but it must be remembered that hunting men do not generally approve of horses having water so placed that they can get it whenever they like. The gutter is wrought iron. The painting used for iron is sometimes also used for walls; it is called the enamelled paint, as many as twelve or fourteen coats being used, at a cost of 2s. 6d. per foot super, the advantage of this paint being that it is not so trying to the eyes of the horses. It is usual to have the manger, &c., lined with vitrified enamel, which he had found very enduring.

The latest invention of the Messrs. Hayward was then alluded to. It consists of a hexagonal and semi-prismatic pavement light

the rear semi-prism illuminating the two in front, and so intensifying the light. The idea of the prism is taken from ship-decks. This new semi-prism can be converted to the old pavement lights, provided they are 4½in. in width. The price of the new patent was stated to be 12s. a foot for stock sizes, smaller sizes 15s. a foot.

The different classes of revolving shutters received attention, but time would not permit to enter into their respective merits or demerits. Bunnett's patent revolving iron louvre blind shutter deserved especial mention, inasmuch as it not only affords thorough ventilation and shade, but is a perfect security against fire and thieves. The laths are made of iron, and the winding gear is the same as for ordinary shutters. By an easy contrivance the grooves in which the shutters run are thrown open, so as to allow the shutter to be louvred; but the shutter *must be fully down* before louvring can take place. This shutter costs about 1s. per foot in excess of the ordinary revolving shutters. It was also mentioned that wood shutters cost about half the price of iron.

The important subject of ventilation was then dealt with, and for external ventilation two kinds commend themselves, viz., Sheringham's patent and M'Hattie's patent, Sheringham's being the cheaper, whilst the other is self-acting. For the removal of heated air Mr. Fletcher recommended those fitted with the silk flap opening from the top; but all internal ventilators should have a separate flue. Arnott's valves and Hart's "model cottage" ventilators were also spoken of. A model of "Nonpareil" patent ventilator and smoke-conductor was exhibited and explained. Sashes and frames were then dealt with, and samples introduced, including Bullivant's noiseless sliding sashes, and also a sample of Hookham's patent steel ribbon sash-line. Water bars and casement fastenings were spoken of, together with sash and shutter fastenings, many specimens of sash-fastenings being produced; and Mr Fletcher also showed how the sash-fastening recommended by Colonel Henderson in his circular could be opened if the sashes did not fit exactly. Many specimens of locks and ...ir furniture were also exhibited and explained. Door-springs and rollers for sliding-..... were introduced. An ingenious letter-box was produced and explained. Samples of electric bells and domestic telegraphs were supplied by Messrs. Adams and Son, together with the *le clanche* battery, which now supersedes all other batteries. Cottage ovens and stoves were spoken of at some length, Mr. Fletcher remarking that the former used by him in his "model houses" were supplied by Mr. H. L. Taylor, of Queen Street, City. Dust shoot-boxes for the use of model houses were also spoken of. In connection with lifts and hoists, an invention by the Messrs. Bunnett, which prevents the box from falling should the rope break, was favourably dealt with. Hydraulic lifts also received attention, and water and earth closets, with their fittings, pipes, &c., came under notice; the patent encased block tin pipe being introduced, and its advantages shown over the ordinary lead pipe. After making some observations on quick-drying, inodorous paint, specimens of work done with it being produced, Mr. Fletcher spoke of enamel, introducing an enamelled iron pie-dish, in illustration of how the enamelled iron might be made of use for domestic purposes; and concluded his reading in these words:—I think there is a grand future for architecture, but it must be by striving to combine in the buildings all the scientific inventions of the day, to do so cautiously and with judgment, and herein new forms will be created by the use of new materials, if only the desire be present not to be slavishly bound by precedent, but earnestly to strive to make the requirements of science express themselves in our works. Whilst, therefore, I contend no architect should have or invent any patent, or have any interest in any, for the reason that he may be tempted to use it when some better thing may have been discovered (and this merely from the natural love we all have for the children of our brain), he should, however, be ever willing to experiment with all the inventions of others, and thus give them aid. I have learnt much whilst perusing my investigations; and if I but lead others to investigate for themselves I am confident they will also learn much.

The CHAIRMAN, in inviting discussion, said that Mr. Fletcher had dealt with a large number of subjects, any one of which would have been sufficient for a whole evening, and he would suggest that the supply of fresh warmed air was perhaps the most important question in building economics; and when it was considered that the estimate was one gallon per minute for each person, the magnitude of that subject would be readily appreciated.

Mr. MAGNUS remarked that the common plan of placing the stove directly under the chimney was very wasteful, as it carried off the heat and warmed the chimney instead of the room. He recognised the fact that the Englishman does not like close stoves. Though he fully appreciates the warmth from such stoves, he does not like the stuffy atmosphere their use engenders. Moreover, the Englishman likes to poke his fire. He pokes it when ill-tempered, and pokes it when good-tempered. He had adapted his enamelled slate to the construction of stoves supplied with air from outer atmosphere, and had found them to answer well. He would refer the members to the various specimens of enamelled slate which were on the table. Its uses were multiform.

Mr EDWARD HALL considered the paper one of great value. As an architect, he could say that a great deal of space would be saved by the plan of Mr. Fletcher for dwellings for the poor. With regard to the little progress made in the practical application of new inventions to buildings he had a few words to say. Architects were very much embarrassed in carrying out improvements from the want of a proper communication between the architect and the workmen who had to carry the improvements into practical effect. The former was often most wofully disappointed by the non-success of contrivances which he had formed a high opinion of, and had introduced into work, under his control. Testimonials as now given were of no practical use on behalf of the architect. He would also observe that he had to get his living by his profession, and, therefore, had to consult the views of his clients, who generally objected to have their breeches-pockets touched in order to enable experiments to be carried on, however promising they might appear to be. He was sorry Mr. Fletcher had to abbreviate, as the whole subject was well worthy of thorough investigation. He agreed with Mr. Fletcher in thinking it would be a good thing if the matter of building improvements were specially and fully discussed by this Society.

The CHAIRMAN said it was now time to close the discussion for that evening, but before doing so he would say that he felt that the Institute was bound to thank the gentlemen who had brought specimens of inventions before them, and he would ask them to bring their specimens before the Society at the adjourned meeting.

JANUARY 18th, 1872. Patent Law Committee's Report—Mr. F. H. Varley in the chair.

Mr. LATHAM (the Secretary) explained that the business of the evening was to bring before the members of the Institute the present state and prospects of the question of Patent Law Reform, more especially in regard to the Committee of Inquiry appointed by the House of Commons last session. The constitution of that Committee had been much objected to, it being, as alleged, for the most part composed of men not likely to be friendly to the inventors' cause, from reasons which had been fully explained in a letter from Mr. T. Mottershead, inserted in the SCIENTIFIC REVIEW for November last. This state of facts made it probable that the report of that Committee would not be one favourable to the inventors' cause; hence it was of the greatest importance that immediate action should be taken by the Inventors' Institute, so as to ensure the appointment of a committee of a more favourable character, or, what would appear to be still better, the nomination of a Royal Commission of Inquiry in lieu of the Commons' Committee. At present the Patent Laws were a network of legal subtleties and expensive formalities, which required immediate and thorough reform. Having made these remarks, he would now ask the Chairman to request Mr. Campin to report on behalf of the Patent Law Committee.

The CHAIRMAN then called on Mr. Campin for the report.

Mr. CAMPIN stated that the Patent Law Committee had attended nearly every sitting of the House of Commons' Committee, and they found that Committee was not too favourable to the views of inventors. Mr. Campin then adverted to the partisan character of many of the members of the Commons' Committee, and criticised the evidence presented to that Committee, expressing his dissatisfaction with the evidence of Mr. Grove, Q.C. (now a Judge), Lord Romilly, Mr. Schneider, Sir R. Palmer, and others, and approving of the evidence given by Mr. Bessemer and Mr. Nasmyth, who appeared to him to be the only witnesses expressing sound practical opinions worthy of the consideration of the House of Commons.

Mr. M. M. HARRIS thought there was no doubt that the appointment of a Royal Commission would be the most advantageous thing for the inventor. On such a commission they might hope to see Mr. Bessemer, Mr. Nasmyth, and other well-known inventors and inventors' friends; whereas a Parliamentary Committee could not obtain their services, since they were not members of the Legislature.

Mr. MOTTERSHEAD concurred in the views of Mr. Harris. Committees of the Legislature were by no means the best bodies for pursuing close and accurate inquiries into anything, they were circumscribed as to time, as to place of meeting, and as to choice of members. In the present case it was of the greatest importance that any inquiring body should obtain evidence from workmen inventors, which seemed to him to necessitate that it should hold sittings not only in London, but in Birmingham, Manchester, and other great industrial centres. At any rate, he would say, overthrow the present Committee, for its existence boded no good to inventors. How could it, when it was constituted, as he had shown in his letter, of altogether antagonistic elements?

The CHAIRMAN thought it would be very desirable that the attention of the Council should be specially directed to the urgency of the matter. He should be ready to bring the subject before that body.

Mr. C. G. CARTTAR then proposed the following resolution, which was seconded by Mr. LATHAM, and supported by Mr. M. M. HARRIS, and carried unanimously:—"That this meeting, having heard the report of the Patent Law Committee, considers it should be an instruction to that Committee to forthwith take measures for arranging a conference of the Council, representative working men, and members of Parliament, to procure the appointment of a Royal Commission of Inquiry, or such other steps as may be thought advisable for obtaining a complete and fair investigation of the question of the Patent Laws."

The next meeting was announced as being on the 1st February, when the adjourned discussion on Mr. Fletcher's paper is to be taken. Inventors of building improvements, although not present at the last meeting, were invited to attend the forthcoming one.

(*Reviews of Books, continued from page 23.*)

Darwinism.—Being an Examination of Mr. St. George Mivart's "Genesis of Species." (Reprinted from the *North American Review*, July, 1871, with additions). By CHAUNCEY WRIGHT, Esq. London: John Murray, Albemarle Street. 1871.

THIS is a work designed to support Darwinism against the attacks of Mr. St. George Mivart. Whether the author has succeeded in his efforts to that end we will leave our readers to judge from the following extracts:—

It may seem strange to many readers to be told that Mr. Darwin, the most consummate speculative genius of our times, is no more a maker of hypothesis than Newton was, who, unable to discover the cause of the properties of gravitation, wrote the often-quoted but much misunderstood words, "*Hypotheses non fingo.*" "For," he adds, "whatever is not deduced from the phenomena is to be called an hypothesis; and hypotheses, whether metaphysical or physical, whether of occult qualities or mechanical, have no place in experimental philosophy. In this philosophy particular propositions are inferred from the phenomena, and afterwards rendered general by induction. Thus it was that the impenetrability, the mobility, and the impulsive force of bodies, and the laws of motion and gravitation, were discovered. And to us it is enough that gravity does really exist and act according to the laws which we have explained, and abundantly serves to account for all the motions of the celestial bodies and of our sea." Thus, also, it is that the variability of organisms and the known laws of variation and inheritance, and of the influences of external conditions, and the law of Natural Selection, have been discovered. And though it is not enough that variability and selection do really exist and act according to laws which Mr. Darwin has explained (since the limits of their action and efficiency are still to be ascertained), yet it is enough for the present that Darwinians do not rest, like their opponents, contented with framing what Newton would have called, if he had lived after Kant, "*transcendental hypotheses*," which have no place in experimental philosophy. It may be said that Mr. Darwin has invented the hypothesis of Pangenesis, against the rules of this philosophy; and so also did Newton invent the corpuscular theory of light, with a similar purpose and utility.

In determining the limits of the action of Natural Selection, and its sufficiency within these limits, the same demonstrative adequacy should not, for obvious reasons, be demanded as conditions of assenting to its highly probable truth, that Newton proved for his speculation. For the facts for this investigation are hopelessly wanting.

From which it would seem that Darwinism does not submit to be judged by the investigation of facts, but rather relies upon the acceptance of its idealities, and this view is strengthened by the following passage:—

Astronomy presents the anomaly, among the physical sciences, of being the only science that deals in the concrete with a few naturally isolated causes, which are separated from all other lines of causation in a way that in other physical sciences can only be imitated in the carefully guarded experiments of physical and chemical laboratories. The study of animals and plants under domestication is, indeed, a similar mode of isolating with a view to ascertaining the physical laws of life by inductive investigations. But the theory of Natural Selection, in its actual application to the phenomena of life and origin of species, should not be compared to the theory of gravitation in astronomy, nor to the principles of physical science as they appear in the natures that are shut in by the experimental resources of the laboratory, but rather to these principles as they are actually working, and have been working, in the concrete courses of outward nature, in meteorology and physical geology. Still better, perhaps, at least for the purposes of illustration, we may compare the principle of Natural Selection to the fundamental laws of political economy, demonstrated and actually at work in the production of the values and the prices in the market of the wealth which human needs and efforts demand and supply. Who can tell from these principles what the market will be next week, or account for its prices of last week, even by the most ingenious use of hypotheses to supply the missing evidence? The empirical economist and statistician imagines that he can discover some other principles at work, some pre-determined regularity in the market, some "innate" principles in it, to which the general laws of political economy are subordinated; and speculating on them, might risk his own wealth in trade, as the speculative "vitalist" might, if anything could be staked on a transcendental hypothesis. In the same way the empirical weather-philosopher thinks he can discern regularities in the weather, which the known principles of mechanical and chemical physics will not account for, and to which they are subordinate. This arises chiefly from his want of imagination, of a clear mental grasp of these principles, and of an adequate knowledge of the resources of legitimate hypothesis to supply the place of the unknown incidental causes through which these principles act. Such are also the sources of most of the difficulties which our author has found in the applications of the theory of Natural Selection.

From this it would appear that the great stronghold of Darwinism is *imagination*, which may possibly be found, in accord with a sufficient number of facts, to give to the imaginings comprised in that system the force and efficacy of scientific principles.

And it would seem that Mr. Darwin himself is beginning to entertain some doubts about the entire correctness of his former views, for it is stated:—

Before proceeding to a special consideration of our author's difficulties on the theory of Natural Selection, we will quote from Mr. Darwin's latest work, "The Descent of Man," his latest views of the extent of the action of this principle and its relations to the general theory of evolution. He says (Chapter IV.):—

"Thus a very large yet undefined extension may safely be given to the direct and indirect results of Natural Selection; but I now admit, after reading the essay of Nageli on plants, and the remarks by various authors with respect to animals, more especially those recently made by Professor Broca, that in the earlier editions of my 'Origin of Species' I probably attributed too much to the action of Natural Selection, or the survival of the fittest. I have altered the fifth edition of the 'Origin' [the edition which Mr. Mivart reviews in his work], so as to confine my remarks to adaptive changes of structure. I had not formerly sufficiently considered the existence of many structures which appear to be, as far as we can judge, neither beneficial nor injurious, and this I believe to be one of the greatest oversights as yet detected in my work. I may be permitted to say, as some excuse, that I had two distinct objects in view: firstly, to show that species had not been separately created, and secondly, that Natural Selection had been the chief agent of change, though largely aided by the inherited effects of habit, and slightly by the direct action of the surrounding conditions. Nevertheless, I was not able to annul the influence of my former belief, then widely prevalent, that each species had been purposely created; and this led to my tacitly assuming that every detail of structure, excepting rudiments, was of some special, though unrecognised, service. Anyone with this assumption in his mind would naturally extend the action of Natural Selection, either during past or present times, too far. Some of those who admit the principle of evolution, but reject Natural Selection, seem to forget, when criticising my work, that I had the above two objects in view; hence, if I have erred in giving to Natural Selection great power, which I am far from admitting, or in having exaggerated its power, which is in itself probable, I have at least, as I hope, done good service in aiding to overthrow the dogma of separate creations."

In one other respect Mr. Darwin has modified his views of the action of Natural Selection, in consequence of a valuable criticism in the *North British Review* of June, 1867; and our author regards this modification as very important, and says of it that "this admission seems almost to amount to a change of front in the face of the enemy."

We certainly must confess that this assumption of Mr. St. G. Mivart's is not really refuted by the very clever criticisms and explications of the author of the present work. The following reads like a little piece of pleasantry:—

Mr. Darwin (says Mr. St. G. Mivart) abundantly demonstrates the variability of dogs, horses, fowls, and pigeons, but he none the less shows the *very small* extent to which the goose, the peacock, and the guinea-fowl have varied. Mr. Darwin attempts to explain this fact as regards the goose by the animal being valued only for food and feathers, and from no pleasure having been felt in it on other accounts. He adds, however, at the end, the striking remark, which concedes the whole position, "but the goose seems to have *a singularly inflexible organisation*." The translation is begun in the author's italics, and completed a few pages farther on (p. 141), where, recurring to this subject, he says: "We have seen that Mr. Darwin himself implicitly admits the principle of specific stability in asserting the singular inflexibility of the organisation of the goose."

Although this subject is a most interesting one, we must at present refrain from further consideration of it. The SCIENTIFIC REVIEW is more an organ for the advancement of experimental science than for the progression of speculative philosophy. We can only say that the author of this reprint from the *North American Review* has handled his subject with considerable ability, although he has failed to convince us that Darwinism is so reliable as he considers it to be.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

AT the meeting of this society on Tuesday, Dec. 5, 1871, Mr. Joseph Cubitt, Vice-President, in the chair, the first monthly ballot for the present session was taken, and resulted in the election of two Members—viz., Mr. Ernest Benedict, Chief Engineer in India of the Eastern Bengal Railway; and Mr. Mark Hyde, Manchester; and of twenty-eight Associates—viz., Mr. Henry Adams, Stud. Inst. C.E., Arundel Square; Mr. Edwin Clerk Allam, Romford; Mr. Emerson Bainbridge, Stud. Inst. C.E., Manager of the Nunnery Collieries, Sheffield; Mr. William Borrer, Horsham; Major James Browne, R.E., Ex. Eng. P.W.D., India; Major Joseph Smith Bryce, New York; Mr. Henry Carter, Stud. Inst., C.E., Westminster; Mr. Octavius Deacon Clark, late Acting District Engineer, G.I.P. Railway; Captain Henry Doveton, R.E., late Assistant Consulting Engineer for Railways, Government of India; Mr. Barrow Emanuel, M.A., Finsbury Circus; Mr. Walter Combermere Lee Floyd, late Engineering Staff of the G.I.P. Railway; Mr. Joseph Rake Harding, Engineer and Surveyor to the Epsom Local Board of Health; Mr. John Jurd, Southampton; Mr. Edward Tiley Lambert, B.A., Surbiton; Mr. Edward John Lloyd, Resident Engineer of the Warwick and Birmingham, and Birmingham and Warwick Junction, and other canals; Mr. Philip Edward Murphy, Brompton, Kent; Mr. Robert Augustus Oldham, Ex. Eng. P.W.D., India; Mr. Christopher Pattison, Naples; Mr. George Fullin Peacock, Stud. Inst. C.E., Inverness Terrace; Mr. Thomas Tenison Ryan, Ex. Eng. P.W.D., India; Mr. William Heron Steel, D.P.W., Melbourne; Mr. Frederick William Stevens, Assist. Eng. P.W.D., India; Major Richard

Hugh Stotherd, R.E., Chatham; Mr. James Strachan, Resident Engineer, G.I.P. Railway; Mr. Arthur Smith Truman, Lisbon; Mr. William Walton Williams, jun., Stud. Inst. C.E., Madrid; Mr. George Walter Winckler, Assist. Eng., Hooblee and Carwar (State) Railway, India; and Mr. Alfred Hope Wood, ...

The Council reported that during the present session, acting under the provisions of Sect. III., Clause 7, of the Bye-Laws, they had transferred Messrs. Harry Pasley Higginson, Alexander McKerrow, John Birch Padden, and William Henry Preece, from the class of Associate to that of Member; also that, in accordance with Sect. IV., they had admitted the following candidates Students of the Institution:—Messrs. William Syson Cundy, Harry Dancer, George Edmund Doorly, James Graham Doorly, Alan Grant-Dalton, George Jessop, William Stronach Lockhart, John Christie Mackay, Alexander William Moore, Alfred Eley Preston, Alphonso Raymond, Cecil Scott, and William Kitson Stent.

December 19, 1871. Charles B. Vignoles, Esq., F.R.S., President, in the chair.—This was the fifty-fourth Annual General Meeting "to receive and deliberate upon the report of the Council on the state of the Institution, and elect the officers for the ensuing year."

The report commenced by stating that in the past session an address had been presented by a numerous body of members and associates recommending that the number of the Council should be increased from seventeen to twenty—the maximum permitted by the charter—that two of such additional councillors should be from the class of members, and one from the class of associates; and that each and every year two of the members and two of the associates of Council should become ineligible for re-election until after the expiration of one year. The result of the deliberations of the Council on this proposal was, in effect, that the suggested increase in the number of their body was neither necessary nor desirable for efficient administration, and that the compulsory retirement every year of the two senior members, for that must have been the ultimate result of the measure as proposed, would in their opinion be prejudicial and disadvantageous to the interests of the Institution. A requisition having been made for a special meeting of members only to consider the question, such meeting was accordingly convened. A full report of the proceedings at that meeting, which was continued by adjournment, as well as at another meeting, had already been issued to every member and associate. Only the more salient points discussed at those meetings were therefore alluded to in the report, and a summary was given of the modifications finally adopted.

A subsidiary question remained, however, to be disposed of—that was the propriety, or otherwise, of recording on the balloting lists the number of the attendance of the members of Council in council and at the ordinary meetings. Such a record had been kept for years; it was only, however, at the annual meeting in 1865 that these attendances were ordered to be printed. Having been so ordered, it was not in the power of the Council to make any alteration in the practice. But as it seemed desirable that the custom should not be continued, and as its continuance would be the means of individualising the old from the new names on the balloting lists—which it had been in part the object of the changes lately made in the bye-laws to avoid—the Council recommended that the attendances should not in future be printed.

As a means of judging how far the Institution had facilitated the acquirement of professional knowledge, and aided in promoting mechanical philosophy during the past year, the ordinary meetings were next referred to. Of these there had been twenty-five, when eighteen papers were read, on very diverse subjects, which were recapitulated. These communications and the discussions upon them had been embodied in two octavo volumes (already issued to all the members), which it was believed must be regarded with unqualified satisfaction. To the authors of several of the memoirs the Council had had peculiar gratification in awarding, out of the special trust funds bequeathed or assigned for the purpose, Telford Medals and Premiums to Messrs. B. Samuelson, M.P., A. Beazeley, T. D. Ridley, and J. Price; a Watt Medal and a Telford Premium to M. Gaudard; Telford Premiums to Sir F. C. Knowles, Bart., and Messrs. W. R. Browne, H. E. Towle, G. B. Rennie, and A. Jacob; and the Manby Premium to Mr. W. Airy, B.A. There had likewise been six supplemental meetings for the reading and discussion of papers by students, and for the essays so contributed Miller Prizes had been bestowed upon Messrs. F. H. Mort, G. G. M. Hardingham, A. T. Atchison, B.A., H. F. Joel, W. Tweedie, F. Wilton, H. O. Smith, and K. W. Hedges. It was stated that the accessions to the library had been more numerous than usual, and that the additions included many valuable official reports on public works in India and in the Colonies. On the occasion of the President's conversazione several changes were made which had been regarded as decisive improvements. Thus, instead of a miscellaneous collection of works of art, only such paintings and water-colour drawings were received as represented some engineering work or matter of interest. Again, in regard to the models, small machines, contrivances, and instruments exhibited in the meeting-room, two or three special subjects were illustrated in a more or less complete series, besides miscellaneous objects. The members generally were urged to continue to make the Institution the depository of accurate information on the existing condition of knowledge and practice in different branches of engineering in all countries, and with regard to machinery and manufactures connected with the profession.

Owing to the increasing number of applications for admission into the Institution, and for transfer from the class of associate to that of member, the Council had had under consideration the rules and regulations respecting the qualifications of candidates. These seemed to be amply sufficient, if strictly adhered to, to insure the election only of those whose avocations and antecedents were such as to render them worthy of the privilege. It had, however, been pointed out that in every case the statement of qualifications must embrace a full and consecutive narrative of the career of the candidate, and that the proposer and seconders must have a *personal knowledge* of the details of the qualifications upon which the application was based. During the past session 11 associates had been transferred to the class of members. The elections had comprised 26 members and 102 associates, together 128, while the deductions due to deaths, resignations, and erasures amounted to 45, leaving an effective increase of 83, being at the rate of 5 per cent. in the twelve months. There had been 50 admissions to the class of students attached to the Institution, and 20 had been removed from the list from various causes, so that the net increase was 30, or 17 per cent. There were on the books on the 30th of November last 14 honorary members, 724 members, 1048 associates, and 203 students, together 1989, as against 945 ten years ago.

The deceases announced during the year included 2 honorary members, F.M. Sir John Burgoyne, Bart., and Sir John Herschel, Bart., both of whom had been borne on the register for 33 years; 11 members (these deaths being at the rate of 15 per thousand), viz., Yman D. C. Suermondt (49), Josiah Parkes (48), Philip Hardwick, R.A. (47), Thomas Wicksteed (34), Robert Benson Dockray (28), James Newlands (23), Albinus Martin (22), Samuel Power (21), John George Blackburne (16), Joseph Hamilton Beattie (14), and Herbert Louis Augustus Davis (4)—who had belonged to the Institution for periods varying from 49 to 4 years, as recorded against each name—the average of the whole being nearly 28 years. Also 22 associates (these deaths being at the rate of 20 per thousand), viz., Lt.-Gen. Sir William Denison (34), Col. J. R. Western (29), Edward Mosely Perkins (28), Ohanes Dadian (27), Robert Ritchie (26), Octavius Henry Smith (26), Charles Frodsham (25), Joseph Freeman (21), Thomas Brassey (19), Edward Price (15), Capt. George Baillie (10), Alfred Stansfield Rake (8), Samuel Tate Freeman (5), Thomas William Gardner (5), Henry George Hulbert (4), Henry Beadon Rotton (4), Samuel Thomas Cooper (4), Henry Yarker Richardson (3), John Hastings Babington (2), Arthur Field (2), Clement Wilks (2), and Henry de la Poire Murphy (2). The average number of years that the associates had been on the books was thus less than 14.

An analysis of the abstract of receipts and expenditure for the year ending the 30th of November last, when compared with the similar statement for the preceding twelve months, showed slightly diminished receipts, due to a smaller number of elections; while the disbursements had been considerably less, although the liabilities were all promptly paid as they were incurred. On the credit side of the account £6022 9s. had been received from annual subscriptions, interest on investments not in trust, and miscellaneous sources, £1201 4s. from fees on admission and life compositions, and £411 16s. 4d. from dividends on trust funds, together £7635 9s. 4d. The disbursements had included on the general account £5019 3s. 11d., in respect of the new building a further sum of £214 13s. 10d. (making the total outlay already incurred £18,491 13s. 2d.), and for premiums under trusts £261 1s. 8d., together £5494 19s. 5d. A sum of £2179 10s. 8d. had been invested in the purchase of £1500 London, Brighton, and South Coast Railway four-and-a-half per cent. debenture stock on the general account, and of £275 17s. and £442 6s. three per cent. annuities representing the balances of unexpected income during the last five years, arising from the Telford and the Miller trust funds respectively. The nominal or par value of the funds belonging to the corporation was £12,156 1s. 8d., and of the trust funds under the charge of the Institution £12,837 18s. 8d., and the cash balances amounted to £379 3s., together £25,373 3s. 4d., as against £23,145 14s. 9d. at the date of the last report. This was irrespective of the value of the lease of the premises, of the books in the library, of the portraits, of the stock of minutes of proceedings, or of other property and effects.

It was mentioned in regard to the Indian Civil Engineering College at Cooper's Hill that the Council had submitted to the Secretary of State for India their reasons for thinking that such a mode of recruiting the engineering establishment of the Public Works Department was neither necessary nor politic. A copy of their minute, with the correspondence on the subject, was given at the end of the report. In reply to this communication the Duke of Argyll had expressed regret that the course he had felt it his duty to take in the matter had not met with the approval of the Council of the Institution of Civil Engineers.

ZOOLOGICAL SOCIETY OF LONDON.

January 2, 1872. John Gould, Esq., F.R.S., V.P., in the chair.—An extract was read from a letter received from Mr. T. G. F. Riedel, of Gorontalo, Celebes, in reference to the true locality of a rare kingfisher, *Tanysiptera riedeli*, which he stated to be from Kordo—an island in the Bay of Geelvink, and not from Celebes. Professor Newton exhibited and made remarks on a specimen of Ross' Gull (*Larus rossi*), from the collection of the late Sir William Milner, which was said to have been obtained in Yorkshire. Mr. Gould exhibited an adult specimen of the same bird from the Derby Museum, Liverpool. Mr. P. L. Sclater read a paper on the species of monkeys found in America north of Panama, being supplementary to a former paper on the northern limit of the quadrumana in the new world. The species of monkeys now ascer-

tained to occur in Central America from Panama to Mexico were stated to be eleven in number—namely, ten belonging to the family Cebidæ, and one to the Hapalidæ. Full particulars were given concerning the range of each of these species. Mr. Henry Adams communicated some further descriptions of new species of shells collected by Mr. R. McAndrew in the Red Sea. A second paper by Mr. H. Adams contained descriptions of fourteen new species of land and marine shells from Mauritius, Mexico, Formosa, Borneo, and the New Hebrides. Mr. George Gulliver communicated a paper on the œsophagus of a hornbill (*Toccus melanoleucus*), being an appendix to a former paper by him on the taxonomic character of the muscular sheath of the œsophagus of the Sauropsida, read at a previous meeting of the society. Mr. J. Brazier communicated some observations on the distribution of certain species of volutes found in the Australian seas. In a second paper Mr. Brazier gave descriptions of six new species of land and marine shells from the Solomon Islands, Western Polynesia, and Australia. Dr. J. C. Cox communicated descriptions of some new land shells from Australia and the South Sea Islands.

JANUARY 16th, 1872. Professor Newton, F.R.S., V.P., in the chair.—The Secretary read a report on the additions that had been made to the Society's collection during the month of December, 1871, amongst which was particularly mentioned a young Prince Alfred's deer (*Cervus alfredi*), born in the Gardens. A letter was read from Professor Owen, F.R.S., communicating some particulars received from Dr. Julius Haast, of Christchurch, New Zealand, respecting the finding of the remains of *Aptornis* in the Glenmark Swamp, New Zealand. Mr. H. E. Dresser, F.Z.S., exhibited and made remarks on specimens of the eggs of *Reguloides superciliosus* and *Reguloides occipitalis*, collected by Mr. W. E. Brooks in Cashmere. A communication was read from Dr. G. Hartlaub, F.M.Z.S., and Dr. O. Finch, C.M.Z.S., giving an account of a collection of birds from the Pelew and Mackenzie Islands in the Pacific, to which was added a complete synopsis of the ornithology of this portion of the Caroline group. A communication was received from Mr. A. Sanders, F.Z.S., containing a complete description of the myology of *Liolepis belli*. Mr. A. G. Butler, F.Z.S., communicated a synonymic list of the species formerly included in the genus *Pieris*, with references to all others described since the subdivision of that genus by recent authors. A communication was read from Mr. John Brazier, C.M.Z.S., of Sydney, N.S.W., giving a list of the *Cypræ*, met with on the coast of New South Wales. A paper by Mr. A. Anderson, F.Z.S., was read, containing the second portion of his notes on the raptorial birds of India.

THE VICTORIA (PHILOSOPHICAL) INSTITUTE.

A MEETING of the members of this society took place on Monday evening, when the Rev. Dr. Robinson Thornton, Principal of Glenalmond College, took the chair.

The honorary secretary, Captain F. Petrie, announced the election of the Rev. Dr. Margoliouth, Mr. J. T. Prichard, and other members; as also donations to the library from the Royal University of Norway; also the Proceedings of the Royal and other societies. From a statement of the progress of the Institute it appears that ninety-one members have joined, and two have retired during the past year.

The paper read was one by Dr. Wheatley on "Chance Impossible," in which the author contended that unless the universe came by chance the Atheist had no ground to argue upon, for he could not build his speculations on created worlds.

A discussion followed, in which the Rev. G. Henslow, in dealing with one part of Dr. Wheatley's argument, took occasion to define the limits which recent scientific researches had reached in regard to the theory of evolution. In speaking of the theory, he, amongst other instances, gave that of the results of various combinations of plants, and contended that the true theory of evolution need in no way alarm those who regarded it as militating against religion, nor as one with what was called Darwinianism.

Dr. McCann, Dr. Rigg, Dr. Wainwright, and others then continued the discussion. At its close it was stated that Dr. Ord would deliver a lecture on "The Influence of Colloid Matters upon Crystalline Forms" at the next meeting.

TECHNICAL EDUCATION MOVEMENT.

THE joint committee on technical education formed at the meeting of the Inventors' Institute have been proceeding with their work, which has resulted in meetings being held at Sir Antonio Brady's offices in Cannon Street.

Among those present on 6th January were Sir Antonio Brady (who presided), Mr. Scott Russell, Mr. R. M. Latham, Alderman Gould, J.P., Captain Mercier, Mr. F. W. Campin, Dr. Mill, Mr. M. M. Harris, Mr. Paterson, Mr. Brighty, and Mr. Mottershead. It was stated by the Chairman that at the previous meeting it was decided to endeavour to unite the committee of working men, the committee of the Inventors' Institute, and the committee for the establishment of a National Technical University, all of which organisations had the same object in view, and that the twelve resolutions submitted at that meeting were, with some modifications, agreed to. The principal modification was to leave out the reference to the estimated sums of money which would be required. The necessity and urgency of having as many schools as possible, which were dwelt upon in one of the resolutions, will be strongly adhered to. It was for this meeting to confirm or disapprove the proceedings of the previous one, and to take such further steps as may be deemed necessary. The question whether the three committees should be combined was discussed, the desirability of having the services of the working men members being much urged. In the event it was resolved, on the motion of Mr. R. M. Latham—"That the committee of working men and the committee of professional men appointed at a meeting of the Inventors' Institute on the 21st December last, do unite with the executive committee of the proposed university for technical education, and form one united committee for promoting the establishment of a national system of technical, industrial, and trade education of the English people. That the following gentlemen form the joint committee, with power to add to their number:—William Allan, engineer; T. Mottershead, silk-weaver; G. Savage, dye-sinker; T. Paterson, cabinet-maker, Henry Broadhurst, stonemason, and Samuel Brighty, woodturner, being the committee of working men appointed on the 21st December; Sir A. Brady, R. M. Latham, J. Scott Russell, Hodgson Pratt, F. H. Varley, and M. M. Harris, the committee of professionals appointed at the same meeting; Mr. E. F. Gourley, M.P., Alderman F. Gould, J.P., Colonel J. M. Carter, Captain Mercier, Mr. G. Bullen, Mr. H. St. John, Mr. F. W. Campin, Mr. J. R. Taylor, Mr. Ratcliff, and Dr. Mill." The most appropriate name for the organisation was considered, but no decision was arrived at; and the business proceedings were concluded by a resolution agreeing to the twelve resolutions, in a modified form, which were adopted at a previous meeting.

On 17th January another meeting was held at Sir A. Brady's offices, Cannon Street, on the subject of technical education.

The proceedings of the last meeting having been reported were confirmed.

After much discussion, it was resolved to provisionally appoint as officers of the new organisation the following gentlemen:—Sir A. Brady, Chairman of Council; Colonel Gourley, M.P., Chairman of Executive; Messrs. Thos. Brassey, Esq., M.P., Treasurer; John Scott Russell and R. M. Latham, Vice-Chairmen of Council; Alderman Gould and Mr. W. Allan, Vice-Chairmen of Executive; Hon. Secs., Messrs. F. W. Campin, Dr. Mill, and Thos. Paterson.

The Provisional Executive to consist of the above-named, and Capt. Mercier and Col. Carter, Messrs. J. R. Taylor, Thos. Mottershead, Bullen, Bright, Broadhurst, M. M. Harris, Savage, and Hodgson Pratt; power being reserved to add to the Council and Executive such names as may be deemed desirable.

On 23rd January another meeting was held at Sir A. Brady's Offices, when a committee was appointed to organise a deputation to wait upon the Government for the purpose of requesting its assistance in carrying out the objects expressed in the 12 Resolutions above stated in the amended form agreed to.

MURPHY'S ROTATORY ENGINES AND PUMPS.

WE have to call attention to the improvements recently patented by Mr. Timothy Murphy, of Clonmel, in the county of Tipperary, in Ireland, in respect of rotatory engines and pumps. We have a full notice of this invention in preparation, with illustrative engravings, but we are compelled to defer its publication till another issue.

GOVERNMENT AND INVENTORS.

A MEMBER of the Institute brings to our notice a most flagrant case of maltreatment of the inventor by a Government department. It appears his invention was approved of and adopted by the Government, who offered the inventor a paltry sum for the absolute possession of the invention, which fell far short of the amount he had paid for the production of samples for the use of the Government.

Recent American Patents.

(*From the Scientific American*).

Window Awning.—Charles C. Moore, New York city.—There is nothing new about the construction of the frame of the window. A strip of cloth, or other suitable material to form a shade, is made of the proper length and width to fit into the frame. The upper edge of the shade is attached to a roller in the ordinary manner. The roller may be a spring roller, or any other kind of a shade roller that may be desired. Triangular pieces of cloth, or of the other material of which the shade is made, may extend nearly to the upper end of the shade, or only half the length. The triangular pieces may be made separate and sewed to the edges of the piece, or they may be all formed in one piece of the requisite width, and cut to reduce them to the desired form. A bar is placed in a hem formed upon the lower ends of the parts. The bar is hinged or jointed at the seam or meeting of the pieces, so that it may be folded together to adapt the shade to be rolled upon and unrolled from the roller with the same facility as an ordinary shade. To adjust the shade for use as an awning, it is passed out of the window, above the upper sash, when the triangular pieces extend nearly to the upper end of the shade proper, and below the upper sash, where the same pieces extend only half the length of the shade proper. The end parts of the bar are then opened out at right angles with the middle part of said bar, and their ends are placed and rest upon the lower part of the window frame, thus forming an awning. The awning is secured in place by cords attached to the lower end of the shade, or to the middle part of the hinged or jointed bar, or at any other point or points equidistant from the joints of said bar, and are secured to hooks, catches, or other fastenings attached to the lower part of the frame. The cords may be the ordinary cords for raising and lowering the shade. If desired or necessary, the edges of the triangular pieces may have eyelets formed in them, to enable them to be conveniently secured to the sides of the casing or frame.

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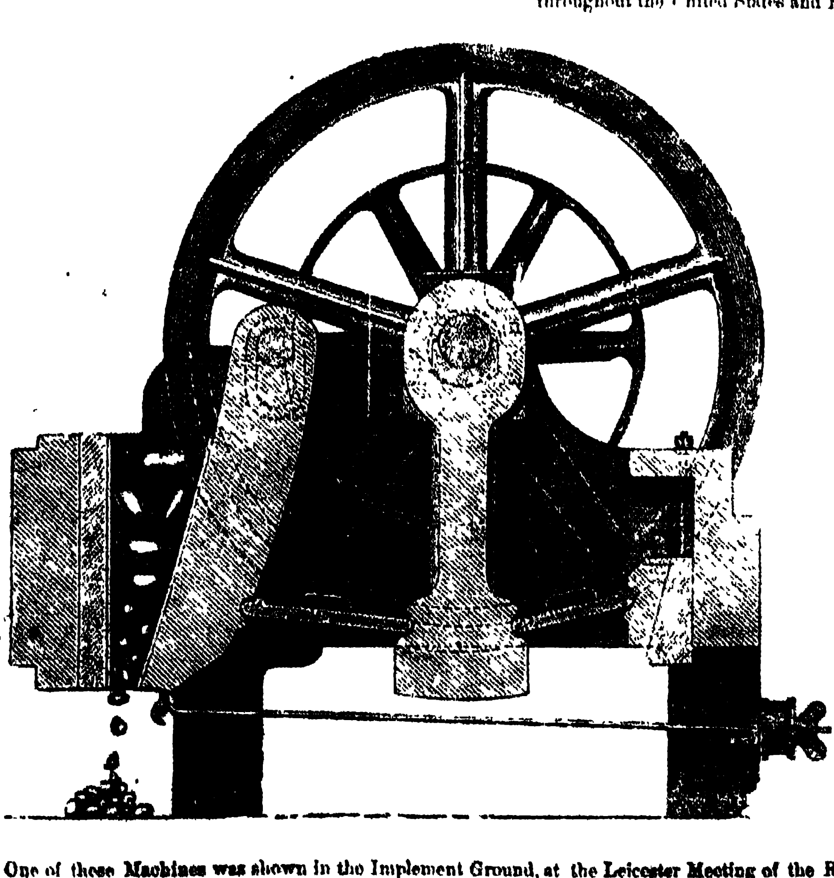

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THE INVENTORS' PATENTRIGHT ASSOCIATION,

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When an Inventor, after, it may be, years of thought and labour, has brought into practical shape the product of his brain, he is, perhaps, assailed with doubts as to the novelty or commercial utility of his invention; he knows little of the process by which his rights in it are to be secured, and he feels some natural apprehension about confiding to mere agents that which has cost him so much, and which, once revealed, may be so readily appropriated by others.

The Inventor, having legally protected his invention, requires influence, capital, and publicity, in order that he may turn it to profitable account. Before he can secure the aid of capitalists or of public bodies, he must establish to their satisfaction that his invention is novel, practicable, and duly protected by law. Its having passed through the hands of a Patent Agent, whatever his position and repute, is no proof that it fulfils those conditions, for the Agent's business is to pass an invention through the proper legal forms without necessarily paying regard to its novelty or utility.

When an invention, fully protected, has been brought into use, and especially if it be one of great value, it is subject to infringement and evasion. The Inventor, frightened at the anxiety and expense of legal process, too often allows infringement to go on, and suffers himself to be robbed of most valuable property, for want of some organised system of defence, to which he may have recourse. He may, it is true, obtain legal assistance, but he cannot, without difficulty, procure from the skilled and experienced such evidence and advice as are necessary for defending his rights against invasion.

Several leading members of the Inventors' Institute, coming daily in contact with Inventors, whose wants and difficulties are daily pressed on their attention, have formed themselves into an association, entitled "The Inventors' Patentright Association, Limited," in order to supply Inventors with the best and most reliable information and advice—to provide skilled references on questions of science and manufacture—to render legal process for protecting and maintaining patentrights safe, cheap, and ready—and to aid inventors in bringing their Inventions into practical and profitable shape. To carry out these views, the Inventors' Patentright Association have set before themselves the following objects:

Objects of the Association.

To obtain Patents for Inventions in this and other Countries.

To Register Designs.

To Sell, and License Patented Inventions.

To form Public Companies, or otherwise arrange for the Public introduction of Patented Inventions.

To furnish Advice and Professional Assistance in developing inventions.

To collect Evidence, arrange Arbitrations, and otherwise assist Inventors in maintaining their rights.

Directions for the Guidance of Intending Patentees.

The operation of an English patent extends over the whole of the United Kingdom of Great Britain and Ireland, the Channel Islands, and the Isle of Man.

All English Patents are granted for the period of fourteen years, subject to the payment of certain Government stamp duties at the end of the third and seventh years.

In order that an Inventor may be placed in a secure position as to his patentright, and come before the public with any chance of commercial success, it is absolutely necessary that the Invention receive Provisional Protection, which secures it for a period of six months.

In order to obtain Provisional Protection, the Inventor should forward to the Secretary full particulars of the Invention, together with a model or rough pen-and-ink sketch, if the Invention be a mechanical one; also a statement of the features of novelty which the Invention possesses.

With all applications for Provisional Protection, either a Provisional or a Complete Specification must be filed at the Government Office. The usual course is to file a Provisional Specification, in which case drawings are seldom required. The Complete Specification must, however, be filed within six months from the date of Provisional Protection; and, if the Invention be a mechanical one, must be accompanied by drawings fully illustrating and explaining it in all its details.

Generally, the personal attendance of an Inventor in London is unnecessary, the transmission to the Secretary of full particulars of an Invention, together with a model or rough pen-and-ink sketch is, in most cases, sufficient.

The Secretary, whenever he is required to do so, gives a written undertaking to an Inventor not to disclose his Invention without his consent.

Scale of Charges.

	£	s.	d.		£	s.	d.
Provisional Protection, including Stamp.	8	8	0	to	10	10	0
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THOMAS MORGAN, Clerk.

The Scientific Review.

MARCH 1, 1872.

FALLACIES OF THE EVIDENCE TAKEN ON THE PATENT LAW INQUIRY.—No. V.

It is certainly gratifying to find that a few of the fallacies put forward by some of the witnesses examined by the Committee have been answered by others—the most notable of those who negative these fallacies being Mr. H. Bessemer, who testifies that the motion so persistently asserted to be a reliable axiom by Mr. Macfie, Sir Roundell Palmer, and others, that the inventor will be sure to be remunerated by manufacturers, is a mere fallacy, by the following statement —

"Had it not been for the law securing my right in my invention by a patent, I could never have hoped, as a simple manufacturer, to recoup myself; and I should never have dared to embark in the iron trade that I knew nothing of, and compete with every manufacturer who could use my invention without the cost and the risk that I myself had had, because he would have known everything at once while I had had to dig it out at great cost. Instead of having an advantage over the trade, I should have had the manifest disadvantage of having expended more capital to produce a given result than, any man who followed me, but with the protection of the patent law, I felt no hesitation in making experiments at a cost of £1000; and when I had recouped myself by the sale of licenses for more than £26,000, so strong was my belief in the ultimate success of my invention, in spite of the unfavourable opinion of the trade, that I persisted. The men who had £10,000 per annum advantage over others made no attempt to carry it out; therefore I still further investigated the invention, and I took out a succession of patents as each new idea or each little increment of improvement was made, and those patents, I believe, now amount to twenty-six in number, under which my invention is secured."

Mr. Isaac Holden (whose absence from Parliament we much regret) also answers another favourite utterance of the fallacy-mongers, by saying :—

"If there was a large industry in Prussia, of course patent law not being secured there, we should suffer in England by the competition. But the very fact that there is a difficulty in getting patents in Prussia, and that when they are obtained they are not reliable, deters inventors from introducing their inventions into Prussia.

"But notwithstanding that there are very large manufactures carried on in Prussia and Saxony, are there not?—Yes. Our industry exists, to some extent, in those countries, but not to any extent equal to France or England. In fact, to so limited an extent is the wool-combing process carried on there that I have never deemed it worth my while to establish a branch house there."

Mr. Chittenden, an American lawyer, likewise speaks in favour of the Patent Law, and so does Mr. J. Nasmyth. In fact, if practical experience is to be our guide, Mr. Bessemer's, Mr. Holden's, and Mr. Nasmyth's opinions ought to settle the question; but as the anti-Patent Law party are like the "deaf adder that stoppeth her ears" we have still to combat one false assertion after another, just as if no practical experience could be brought to bear upon the matter; so we have again to meet our old enemy, Sir W. Armstrong, and his averments, that the Patent Laws obstruct the progress of industrial improvement without effecting any adequate good for inventors. Sir William, however, is by no means so thorough-paced as Mr. Macfie and Sir Roundell, for he says (Questions and Answers, No. 2274 and 2275) :—

"Mr. Bessemer's invention is said to have cost at least £30,000 before it was in such form as to be capable of being commercially used; do you think that an inventor would probably be able to find the means of perfecting an invention of that character, unless he could give to those who supported him with capital some protection, or some hope of future reward arising out of a patent monopoly?—I can only speak of my own case; I have in many instances gone to a very great outlay without having the protection of a patent; the absence of protection never deterred me from incurring expense; I have spent immense time, labour, and trouble on inventions, not caring to take out any patent.

"It is fortunate for the public that you are in a position to do that, but you are doubtless aware that many inventors are not so favoured as you are?—I think an inventor will always, if he has a meritorious invention, find a capitalist; but the case you put is one of those where, I think, there is an argument in favour of some amount of protection, *and if protection was given with discrimination, and only in those exceptional cases, I should be satisfied.*"

A view of the matter that seems to be totally inconsistent with the idea that the principle of the Patent Law is radically wrong.

On the roll of anti-Patent Law witnesses, last but not least, we have the arch-enemy Mr. Macfie, who thinks the Patent Law wrong, root and branch—altogether unsound and rotten, and incapable of amendment. However, he too, as we all know, has some doubt about inventors continuing to work without the incentive of *quid pro quo*, and, therefore, proposes a sop to Cerberus, in the shape of Government rewards—a scheme that we have heretofore demonstrated to be illusory and impracticable; but when we mention that Mr. Macfie was asked Question 2563—"You think that State honours would be a sufficient reward for inventions?" and answered "Yes; in most cases," our readers will see that Mr. Macfie must be a baby in the ways of life, whose opinion upon any of its practical concerns (except perhaps the mere huckstering of daily commercial life) is not worth two straws.

Perhaps Mr. Macfie will permit us to ask What is the alimentive value of honour? How long will it sustain life?

But beyond all dispute Mr. Macfie's notions of the claims of working-men inventors deserve to be had in remembrance by a grateful country. On that subject he says in answer to Question 2541—

"I think working men, if they see that an improvement can be made, or even if they have perfected an improvement, have a tendency not to communicate it freely, but to wait until they get hold of some person of capital, or get into another position where they may make use of it, whereas, if there was not that motive, *they would let their employers have it at once.*"

That is to say, Mr. Macfie thinks an employer is entitled to utilise his workman both "body and soul" getting his labour in return for his wages, and obtaining his invention into the bargain. We commend this notion of Mr. Macfie's to the working-men of his constituency.

Reviews.

The Technical Educator.—An Encyclopædia of Technical Education. Vol II. Cassell, Petter & Galpin, Ludgate Hill, London, E.C , and 596, Broadway, New York.

THE present is the second volume of this truly excellent work, the first volume of which we reviewed some months ago. We find a continuation of the admirable articles and essays contained in the first volume, with additions on Fortification, "Great Manufactures of Little Things," the lathe, mining and quarrying, construction of museums, object drawing, sanitary engineering, and technical education on the Continent, written by W. G. Gladstone, Esq., Mr. Ellis Davidson, Mr. W. J. Piper, Mr. J. Grant, R. P. Ball, M.A., &c., and J. Timbs, the names alone speaking for the excellent and instructive information found in the volume. The volume is furnished with excellent practical woodcuts illustrative of the different papers.

Theory of Heat.—By J. CLERK MAXWELL, M.A., LL.D. Edin., F.R.S.S. L. and E., Professor of Experimental Physics in the University of Cambridge. London: Longmans, Green, and Co. 1871.

THIS is one of the text-books of science now publishing by Messrs. Longman, and it is beyond all question the right book to place in the hands of a student of physical science. Our readers will readily understand the character and object of this work from the following quotation from the preface:—

The aim of this book is to exhibit the scientific connection of the various steps by which our knowledge of the phenomena of heat has been extended. The first of these steps is the invention of the thermometer, by which the registration and comparison of temperatures are rendered possible. The second step is the measurement of quantities of heat, or Calorimetry. The whole science of heat is founded on Thermometry and Calorimetry, and when these operations are understood we may proceed to the third step, which is the investigation of those relations between the thermal and the mechanical properties of substances which form the subject of Thermodynamics. The whole of this part of the subject depends on the consideration of the intrinsic energy of a system of bodies, as depending on the temperature and physical state, as well as the form, motion, and relative position of these bodies. Of this energy, however, only a part is available for the purpose of producing mechanical work, and though the energy itself is indestructible, the available part is liable to diminution by the action of certain natural processes, such as conduction and radiation of heat, friction, and viscosity. These processes, by which energy is rendered unavailable as a source of work, are classed together under the name of the dissipation of energy, and form the subjects of the next division of the book. The last chapter is devoted to the explanation of various phenomena by means of the hypothesis that bodies consist of molecules, the motion of which constitutes the heat of those bodies.

In order to bring the treatment of these subjects within the limits of this text-book, it has been found necessary to omit everything which is not an essential part of the intellectual process by which the doctrines of heat have been developed, or which does not materially assist the student in forming his own judgment on these doctrines.

For this reason, no account is given of several very important experiments, and many illustrations of the theory of heat by means of natural phenomena are omitted. The student, however, will find this part of the subject treated at greater length in several excellent works on the same subject which have lately appeared.

The subject is treated under several chapters, referring to thermometry, or the registration of temperature, calorimetry, or the measurement of heat, elementary dynamical principles, measurement of internal forces and their effects; lines of equal temperature on the indicator diagram; adiabatic lines; heat engines, relations between the physical properties of a substance, latent heat; thermodynamics of gases; on the intrinsic energy of a system of bodies; on free expansion; determination of heights by the barometer; on the propagation of waves of longitudinal disturbance; on radiation; on convection currents, on the diffusion of heat by conduction; on the diffusion of fluids; on capillarity; on elasticity and viscosity, and on the molecular theory of the constitution of bodies.

Perhaps Mr. Clerk Maxwell's admirably easy, lucid manner of treating his subject will be best understood from the following quotation from his chapter on the molecular theory of the constitution of bodies.

We have already shown that heat is a form of energy, that when a body is hot it possesses a store of energy, part at least of which can afterwards be exhibited in the form of visible work.

Now energy is known to us in two forms. One of these is kinetic energy, the energy of motion. A body in motion has kinetic energy, which it must communicate to some other body during the process of bringing it to rest. This is the fundamental form of energy. When we have acquired the notion of matter in motion, and know what is meant by the energy of that motion, we are unable to conceive that any possible addition to our knowledge could explain the energy of motion or give us a more perfect knowledge of it than we have already.

There is another form of energy which a body may have, which depends, not on its own state, but on its position with respect to other bodies. This is called potential energy. The leaden weight of a clock, when it is wound up, has potential energy, which it loses as it descends. It is spent in driving the clock. This energy depends, not on the piece of lead considered in itself, but on the position of the lead with respect to another body, the earth, which attracts it.

In a watch the mainspring, when wound up, has potential energy, which it spends in driving the wheels of the watch. The energy arises from the coiling up of the spring, which alters the relative position of its parts. In both cases, until the clock or watch is set agoing, the existence of potential energy, whether in the clock weight or in the watch-spring, is not accompanied with any visible motion. We must therefore admit that potential energy can exist in a body or system all whose parts are at rest.

It is to be observed, however, that the progress of science is continually opening up new views of the forms and relations of different kinds of potential energy, and that men of science, so far from feeling that their knowledge of potential energy is perfect in kind, and incapable of essential change, are always endeavouring to explain the different forms of potential energy; and if these explanations are in any case condemned, it is because they fail to give a sufficient reason for the fact, and not because the fact requires no explanation.

The Discovery of a New World of Being.—By GEORGE THOMSON. London: Longmans, Green, and Co.

THIS is one of those recondite metaphysical treatises that occasionally issue from the press, gladdening us with the idea there are still some persons left in this materialistic world of ours who have the inclination and leisure to indulge in the abstruse mental exercise of investigating the character and attributes of man considered as an intellectual being.

Our space can always be fully occupied with matters pertaining to the physical and natural sciences, therefore we are not able to do more than give a single quotation from this work. We think it will enable our readers to gather a tolerably correct notion of Mr Thomson's views. But they should peruse the work for themselves in order to fully understand and appreciate them. The reader will find the style of language Mr. Thomson adopts is easy and interesting. He begins with what he terms "The Proposition," and in speaking of this he remarks :—

Every imagination or idea, in its elements, is the semblance or likeness of the material or natural, but in its form may be either copied or original; may be either the likeness of a natural form, or a pure creation. To see this, however, is very difficult without demonstration; and we cannot, in this essay, wait to demonstrate it, because it would occupy too much time, and be too great a digression from our main argument. We may mention, however, that we have devoted an essay to the sole purpose of its demonstration.

After I had written about ten other essays, and still much wondering at this wonderful power of the mind, how it could create out of nothing, I found that the mind itself was a creation, and not a creator. I found that every manifestation of what is called mind was a creation out of nothing to us, while mind continued to be the limit of the realised known, by realising for the first time, in November, 1867, my absolute existence, above and beyond all that is known, or can be known, in other words, by emancipating the conscious and knowing we, ourselves, from mind.

By this discovery, creating out of nothing became an utter absurdity, or, in other words, became an intelligible and natural process; for all the mystery of the nothing, though not of the creating, vanished in the realising of the absolute existence of the conscious and knowing we.

The way I discovered my absolute existence was by observing the non-conscious feature of our being, which is common to all men, whether realised or not, both while mind is the limit of the realised known, and after our absolute existence is discovered.

Like a flash of lightning, this moment we are conscious, the next, we are non-conscious. This moment, we are in conscious activity, the next, in unconscious repose. This moment, we are in conscious existence, the next, we are unconscious of any existence. This moment, we have conscious unity, identity, and individuality; the next, we are to ourselves, in "the womb of uncreated night." We are, to ourselves, perpetually flashing into being, and as quickly relapsing into non-existence. We are, to ourselves, nothing but a perpetual play of existence and non-existence. Literally, the play of lightning is nothing to the rapidity of the incessant throbbing of our spiritual being. Time has not wings to measure it. The silent prayer of unbroken attention alone can behold it.

The non-comprehending of this apparently mysterious feature of our being is the rock upon which thousands have made shipwreck; is the narrow bridge over the gulf of darkness from which men, treading unwarily, have tumbled headlong into the depths of error, infidelity, and despair. On the other hand, the comprehending of this apparently mysterious feature of our being is the walking across the narrow bridge between two worlds; is the walking across the narrow bridge leading from a world which we know to the portals of another which we know not; is the walking across the narrow bridge leading from a world which we see, but to which we do not belong, to another to which we belong, but which we have no eyes to see; is walking across the narrow bridge leading from that world in which we, the knowers, think we are, to that world in which we, the knowers, think we are not, but in which we are; is, in a word, for the first time, to recognise our own existence, or, perhaps more precisely, to realise a new existence, in absolute distinctness, as a person-

ality, from all that is known, and who is the author and creator of the universe and all that it contains, and from whom emanate all things, and by whom all things were made that are in known existence, and without whom there is nothing existent that is known to us. We receive personality, and are sent out from God, and create the worlds; because God, personally, has done nothing that we know. He makes us do the whole; we the sons, and not the Father, are the authors of all the known.

Volcanos. The Character of their Phenomena, their Share in the Structure and Composition of the Surface of the Globe, and their Relation to its Internal Forces. With a Descriptive Catalogue of all known Volcanos and Volcanic Formations. By G. POULETT SCROPE, F.R.S., F.G.S., Memb. Roy. Acad. Naples, etc. Second Edition, revised and enlarged. With Prefatory Remarks, and a List of Recent Earthquakes and Eruptions, also a Map of the Volcanic areas of the Globe. Frontispiece, Woodcuts, etc. London: Longmans, Green, Reader and Dyer. 1872.

THIS is a second edition of Mr. Scrope's well-known and valuable work, and although it has not been recast the author, in order to render its information *au courant*, has added a list of the most important earthquakes and eruptions which have taken place within the past ten years in districts habitually subject to similar occurrences, and in reference to the new matter he has the following prefatory remarks:—

But the phenomena described are in no case of a character materially different from those recorded in the earlier catalogue (pp. 311-182).

In regard to the theoretical portion of the subject, that is to say, the supposed cause of subterranean activity, there has been of late a considerable amount of speculation put forward by various writers, of which some notice may be fitly taken here.

1. *Assumed igneous fluidity of the interior of the Globe.*—In particular, much controversy has appeared for and against the presumed igneous fluidity of the interior of the globe, and its secular refrigeration from a condition of universal fusion, or perhaps of intensely heated nebular vapour slowly condensed into and upon a fluid nucleus.

Now I would remark, in the first place, that these speculations are based on *à priori* conjectures, not on any recorded facts, and belong, moreover, to the province of astronomy rather than of geology. Secondly, I earnestly protest against the assertion of some writers, that the theory of the present internal fluidity of the globe, is or ought to be generally accepted by geologists, on the evidence of its high internal temperature.

It is no doubt an attractive sensational idea, that a molten interior to the globe underlies a thin superficial crust, its surface agitated by tidal waves, and flowing freely towards any issue that may here and there be opened for its outward escape; but I do not think it can be supported by reasoning based on any ascertained facts or phenomena. M. Delaunay has, it is true, disposed of the well-known astronomical argument of Mr. Hopkins and Sir W. Thomson, as to the entire or nearly entire solidity of the earth, derived from the nutation of its axis. But it by no means follows that other arguments in support of the same conclusion are equally invalid. Indeed, Sir W. Thomson, at the recent meeting of the Association at Edinburgh, brought forward another, resting, as I understand it, on the absence of tidal movements in the solid crust of the globe, such as, according to his calculation, could not but take place if its substance were not far more rigid on the whole than a globe of solid glass.

If, indeed, we are to theorise at all on the hypothesis that the earth originated from the condensation of a mass of nebulous vapour into an incandescent fluid state, it would seem probable, as Mr. Hopkins has suggested, that solidification would begin at the centre and advance towards the surface, and that only after a long continuance of this process a time may have arrived when the remaining liquid matter, being of inconsiderable thickness, the surface also would begin to solidify by radiation of its heat into space; from which time the further solidification of the interior would proceed in two directions, outward from the central hardened nucleus, and inward from the external crust. Ultimately the whole might be solidified, or some portions of liquid, or partially liquefied matter, might remain in a thin belt, or more probably in pockets or vesicles here and there, at varying but still moderate distances from the outer surface.

The existence of such pockets, side by side, or even one above the other—sometimes solidified by increase of pressure or the outward escape of heat, then again, perhaps, liquefied by diminution of pressure, or through increased heat reaching them laterally, or from beneath by conduction—will account for, indeed seems to be necessitated by, the phenomena of earthquakes, volcanic eruptions and elevations and depressions of the surface-rocks (see pp. 265-276, *infra*). This view of the complete, or almost complete, solidity of the subcrustal mass of the globe is, I think, rendered still more probable when we consider the enormous *pressure* to which every portion of the heated interior must be subjected, not merely from the weight or contraction on cooling of the outer belt, but still more, perhaps, from the vast internal tension of its every part, owing to the tendency to expansion caused by its intense heat, and this whether that part be in a solid, fluid, or gaseous state. More assuredly will this be the case if we suppose, as we reasonably may, that at least the first layers of matter immediately underlying the external crust consist of the same crystalline or granular mineral substances (chiefly felspathic silicates) which constitute the lowest known rocks, granitoidal or porphyritic, portions of which in every part of the globe are known to have forced their way upwards in a more or less liquefied state, and at an intense temperature, through the overlying stratified masses. These rocks are found on examination to contain a considerable quantity of water disseminated through them interstitially, or in minute cavities, and it is obvious what an amount of internal elasticity or tension must be communicated to such a mass, at its certainly high temperature, by the tendency of these minute particles of water to expand into vapour.

It appeared to me long since, and I expressed the opinion in the first edition of this work (Longmans, 1826), that it is the flashing into steam of this interstitial water contained at a white heat in the crystalline or semicrystalline matter of lava that occasions its ebullition in the focus or subterranean reservoir of a volcano, and its extravasation through fissures opened by its expansive force across the overlying rocks. The immense volumes of steam that rise up the throat of the volcano during an eruption, and the quantities that escape from the surface of the extruded lava on its reaching the air, while much still remains entangled in the matter as it becomes solid, either in cells or pores, show that the water from which the steam derives must have permeated the entire substance of the subterranean lava mass. And the general tension thus occasioned amply accounts for the earthquake shocks that precede an eruption, as well as for the eruption itself.

But it may be asked, how is the equilibrium disturbed or prevented, which must necessarily tend to establish itself between the forces of subterranean expansion and the repressive action of the superficial crust, compounded of its weight and cohesion? The answer is, I think, to be found in the irregular transmission of heat, which, on the supposition of an intensely heated nucleus, we know must be going on perpetually both from beneath, and also from the sides of volcanic fissures, to supply the occasional loss of heat during eruptions, every one of which must to some extent cool down the focus whence the lava and steam have escaped into outer space. Moreover, the secular accumulation of sedimentary deposits over large areas of the submarine surface must, by checking the outward escape of heat in those localities, augment the temperature of the layers of matter beneath (just as an overcoat or a blanket increases the surface-heat of a living body), and cause heat to flow laterally towards those avenues for its outward escape which are from time to time afforded by volcanic fissures or earthquake disturbances. This latter view, suggested in the first edition of this work, published in 1826 (p. 30), was subsequently enunciated by Mr. Babbage, in his paper "On the Temple of Serapis," and obtained the support of the late Sir J. Herschel.

In pp. 277-287 of this edition, I have shown how expansions of the subterranean matter so occasioned must tend to create prolonged fissures through the overlying rocks, into which the intumescent matter will often be injected—causing vibratory shocks that will be felt at greater or less distances—sometimes thrusting up the rocks on either side in dislocated or crumpled masses, owing to the squeeze or jam produced by opposite lateral or diagonal pressures—sometimes, when the heated matter has risen within some downward-opening fissure sufficiently to communicate with the open air, venting itself outwardly in floods of lava and explosions of steam. Hence the general coincidence of linear volcanos and mountain-chains, the intervening flatter areas between these eruptive fissures undergoing at the same time either a gradual elevation like a *creep*, or more frequently, perhaps, slow subsidence—the prime cause of all these local changes being, the irregular transmission of heat by conduction from one part of the subterranean matter to another, its isothermal planes varying with the changes in the conductivity of the overlying rocks (see *infra*, p. 274 *et seq.*).

We commend the following general conclusions to the attention of our readers:—

General Conclusions on Telluric Phenomena.

1. The earliest ascertainable condition of the lowest known matter forming the substance of the globe is that of a granitoidal trachytic compound, consisting generally of felspar, quartz, and mica, in a crystalline or granular, but nevertheless at times, if not always, in a softened and semi-liquid state, owing apparently to the interstitial mechanical mixture of water or the vapour of water, holding probably more or less silex in solution, among its crystals, this "magma" being at an intense, and occasionally an increasing temperature, and consequently in a state of violent elastic tension, by which it presses forcibly against the overlying and resisting solid masses.

2. The highest layers of this matter seem to have been by that outward pressure, acting on them while in a pasty or semi-solid state, so squeezed and set in motion whenever the giving way of the overlying rocks allowed of any upward movement, as to acquire a more or less laminar arrangement of their component crystals, and in this state to have been repeatedly split and penetrated by the intrusion of some of the more liquid matter beneath, and often bodily forced up the axial fissures of dislocation in crumpled zigzag folds or upright walls of solid crystalline laminated rock, to the outer surface of the globe. In their rise they would necessarily shoulder off on either side huge masses of the overlying strata, which, shoved horizontally, or sliding down laterally by their own weight, have been in their turn likewise, when sufficiently soft or pliable, crumpled up into more or less irregular parallel folds, of which the flexures are necessarily deepest, most frequent and close near the axis of elevation, and gradually

become lower and wider as they recede from it—subject, of course, to frequent irregular variations in the direction and amount of flexure, determined by their greater or less solidity and structural arrangement, as well as by the interference of pre-existing resistances, or subsequent change of position.

3. The fissures which by these disturbances are formed in any of the solid rocks in such positions as to open or gape downwards into the heated lava or granitic matter beneath (and such will be for the most part formed along the margin of the elevated areas, or the inferior bends of the rocky flexures, where the strain is most intense), will be injected by the instantaneous intumescence of this matter (owing to its comparative relief from pressure), which on consolidation will seal up the fissure and produce a plate or "dyke" of crystalline igneous rock.

4. The snap and jar accompanying the rending of every such fissure and the violent injection of heated matter into it occasion an undulatory vibration in the adjoining masses of solid rock forming the sides of the rent, which, transmitted through the continuation of those beds, produces the effect of an earthquake-shock, more or less violent in proportion to the force and magnitude of the rent, the intensity of the preceding tension, the position of the point or line of fracture, and the nature of the rocks through which the shock is transmitted. And the superficial fissuring of the strata above by the transmission of these earthquake waves probably produces many of those minor cracks, or solutions of continuity, and faults (that is, irregular elevation or depression of the alternate sides of a crevice) which are so numerous in all elevated strata.

5. It is only when a crevice penetrates to some pocket or focus of liquefied igneous matter that it gives occasion to the formation of a dyke; and should the upward projection of such matter force it so far up a fissure as to obtain free, or approximately free, communication with the atmosphere or shallow water, it will enter into violent ebullition (*i. e.* volcanic eruption), more or less temporary, until the extravasation of heated matter and escape of vapour have cooled down the contents of the fissure, or the portion of underlying matter with which it communicates, so far as to give the predominance to the ever-powerful forces of repression.

6. The mineral matter (lava) so erupted is sometimes in a state of complete glassy fusion, but more usually in one of more or less imperfect crystallisation, the mobility imparted to the component granules or crystals by interstitial heated water or steam in a great degree occasioning its fluidity, though this is often very imperfect. The escape of this vapour hastens the consolidation of the matter, and the resulting lava-rock is usually more porous and fine-grained than the plutonic lava consolidated under greater pressure, and is more varied in mineral character, owing, probably to changes which it has undergone during repeated fusion (or liquefaction) and recrystallisation under varying conditions of pressure and temperature previous to its eruption.

7. The erupted matters, both fragmentary and consolidated, generally accumulate over the vent in a conical mound, the orifice whence the eruptive explosions proceeded being marked by a saucer or cup-shaped hollow or crater. By the accumulation of repeated ejecta a volcanic mountain is formed, composed generally of alternating beds of fragmentary matter and consolidated lava. These are usually penetrated by numerous dykes, by the injection of which into its mass the bulk and height of the mountain are also more or less augmented.

8. These outward eruptions of the internal heated matter are sometimes accompanied or followed by the subsidence of the surrounding or adjoining area (together with the superposed volcanic masses), sometimes by its elevation. And, as a general fact, the upheaval by plutonic action of any area of the globe's surface is usually attended by the subsidence of some other not very distant area, and by volcanic eruption from some adjoining or intervening point or series of points.

9. There is reason to believe that the originating cause of these changes in the crust of the earth is the unequal transmission through it of heat from beneath upwards, owing to variations in the covering surfaces from the deposition of marine and other aqueous sediments at the bottom or on the shores of the ocean, and the abrasion of the land—heat being thus driven to accumulate partially, increasing in some parts, diminishing in others, according to the varying weight and conducting powers of the overlying masses. When the temperature is increasing, and the subterranean matter consequently swelling, the area above suffers elevation with all its accompanying phenomena where it is decreasing, the overlying subaqueous or subaerial areas undergo depression, from the shrinking of the matter below.

10. The source of the internal heat of the globe, which is the *primum mobile* of the whole series of changes, is a question the solution of which I will not attempt, further than by saying that I do not believe it to be owing to the oxidation of any metallic nucleus by penetration of water or the atmosphere (a theory given up by Davy, its inventor); nor do I understand how it can be due to the generation of electric currents within the globe, as has sometimes been suggested. Some writers still insist upon the fact of volcanic orifices being found generally in islands, or adjoining the sea, as proving that their phenomena are occasioned by the access of water from above to the volcanic focus beneath. Two leading objections to this view have always constrained me to reject it, viz., 1st, that a motive power is wanting to initiate the series of operations, by forming the fissures through which the water is to penetrate to the volcanic focus; 2ndly, that, supposing these to be formed in some unknown manner (of which the theory does not afford a glimpse), the result might possibly be a sudden explosive outburst, but hardly the long-continued, sometimes even permanent and almost tranquil eruptions, which are among the ordinary phenomena of active volcanos. I incline rather to the supposition of a gradually cooling nucleus, still retaining much of the intense temperature possessed by it at the time of its original formation. The nature of heat, however, is as yet such an impenetrable mystery, that this is a region of conjecture into which I scruple to enter.

The theory suggested above as to the emanation of the central heat not only provides a reasonable origin for plutonic upheavals and the formation of fissures and faults, but also for the occasional extravasation and ebullition of some portion of the subterranean mineral matters (known, as far as we are acquainted with them, to contain water) which increased temperature or diminished pressure has liquefied and caused to effervesce. It moreover accounts for the relative geographical position of the elevated ranges and the eruptive ones. One hypothesis alone suffices to explain the whole series of terrestrial phenomena — elevations and subsidences in mass, earthquake-shocks, and volcanic eruptions, as well as their mutual relations—that hypothesis being, the shifting of the flow of heat (which we know to be continually rising out of the interior of the earth) from one subterranean mass of mineral matter to another. It has been shown that such a shifting is not only probable, but inevitable, through the ever-varying capacities for the conduction of heat of those areas of the globe which are respectively subaërial and subaqueous—variations that must necessarily arise from the varying influence of the oceanic, meteoric, and organic forces.

This theory seems to me to explain both the plutonic and the volcanic phenomena better than any other, and the harmony and general accordance of all its parts are the best tests of its truth.

From the foregoing it will be seen that the new additions add materially to the value of the work, which is one now so well-known and appreciated that it needs no commendations from us, though it richly deserves them.

Technical Arithmetic and Mensuration.

By Charles W. Merrifield, F.R.S., &c. London: Longmans, Green, and Co. 1872.

This is truly a scientific treatise on arithmetic, with a complete exemplification of the use and application of arithmetic to technical purposes.

The following is a good exemplar of the contents of this work as regards the portion which treats of the application of arithmetic to machines, work, &c.:—

The Application of Arithmetic to Machines, Work, and Motion.—By a machine is to be understood any contrivance for converting force or continued pressure into mechanical work, for transferring mechanical work from one place to another, or for transforming it. A machine does not create work, but only transfers or transforms the mechanical work supplied to it. The meaning of the term *mechanical work* will be explained further on.

In this chapter I shall assume certain mechanical principles to be understood, and I shall state certain formulæ without proof. These are all elementary formulæ which may be found with their proofs in all good books on mechanics—a subject which I do not here profess to teach. My object in this chapter is to bring together certain applications of arithmetic which all mechanists need, but which, so far as I know, are only to be found scattered in treatises on mechanics, hydrostatics, and hydraulics. Incidentally, I give the arithmetic of falling bodies.

Mechanical Work and Power.—A force which has been allowed to act freely on a body, so as to move it from rest through a given space, is said to have done a certain quantity of mechanical work. In consequence a certain velocity will have been impressed on the moving body. To take this velocity out of it, and to bring it again to rest, requires an equal amount of work to be done in the opposite direction. In the same way any change of velocity requires an expenditure of mechanical work.

Mechanical work is measured by reference to the work done by a constant force. Such a force, for all ordinary practical purposes, is the force of gravity acting at or near the surface of the earth. The actual measure is the quantity of work done by gravity when a unit of weight is allowed to fall freely from rest through a unit of space. The more ordinary way of stating this is by an inversion; namely, by neutralising the work of gravity by lifting a body against it. The work done in lifting a body through a space against gravity, and leaving it at rest at the top of the lift, is the same as would be done by gravity in letting it fall through the height lifted. The English measure of work is one pound lifted one foot high, and is called a foot-pound. The French measure of work is one kilogramme lifted one mètre high, and is called a kilogrammètre.

Three pounds lifted one foot high is three foot-pounds, and one pound lifted three feet high is also three foot-pounds. Hence four pounds lifted seven feet high, or fourteen pounds lifted two feet high, is twenty-eight foot-pounds. This facility of comparison is of great advantage in the application of the principle of mechanical work.

Thus if 1000 gallons of water have to be raised to the height of 100 feet, the work to be done is (100 × 1000 × 10) a million foot-pounds, and you cannot get the water up unless you expend that amount of useful work upon it. You may waste part of your work, and you may spill part of your water, but if you have only half a million of foot-pounds at your disposal, you can no more do the work without adding more foot-pounds of work than you can raise 1200 gallons without

adding 200 to the 1000 gallons of water which you have in your tank.

The measure of work may be expressed not only in foot-pounds, but in the product of any lineal measure into any weight; thus foot-tons, inch-pounds, grammètres. In England we use foot-pounds for ordinary work, foot-tons for heavy work, and inch-pounds for small work.

It is necessary to be careful not to confuse foot-tons with feet per ton. Thus one foot-ton, or ton-foot as it is sometimes called, is 12×2240 inch-pounds, while one foot per ton is $\frac{12}{2240}$ inches per lb., and one ton per foot is $\frac{2240}{12}$ lbs. per inch.

It is well to draw attention to the specific difference between work and pressure. A resisted pressure is not work. A weight resting on a table is not doing work. Work implies pressure acting through space, that is to say, moving something through some definite distance. It is pressure with motion, not pressure without motion.

A man supporting a weight is not doing external mechanical work. Whatever internal work may be going on in his muscles, the weight remains at rest, and the man's want of ease, or fatigue, is not external work.

Work may be expended in various ways besides lifting, as in friction, in the production of heat, in breaking up materials, in condensing or expanding gases. In speaking of the efficiency of machines for the transmission of work, all these expenditures are called "*lost work.*" What remains is called the *useful work*. Thus if a steam-engine exerts a million foot-pounds on a pump, and has only raised 500 gallons 100 feet, there is half a million foot-pounds of work as effectually lost as if the whole 1000 gallons had been raised and half of it "spilt." The ratio which the useful work got out of a machine bears to the work put into it, is called the efficiency of the machine. Thus, in the example just given the efficiency of the pumping gear, as a machine, is ·5.

In this illustration the water is supposed to be delivered from the machine and left at rest. If it was taken from rest, but retains velocity on its delivery, there is "work left in it," and that work must be taken out of it to bring it to rest.

Heat is now recognised as a particular form of motion. Variations of temperature involve changes of motion, and thereby involve work. In the steam-engine the combustion of coal produces heat, and part of that heat is converted into mechanical work. A very small part only, however, is thus utilised. One pound of water, having its temperature lowered one degree of Fahrenheit's thermometer, gives out 772 foot-pounds of work. On the other hand, most applications of mechanical power expend part of their work in the production of heat, which is for the most part wasted.

For details of the conversion of heat into work the student must be referred to works on the steam-engine or treatises on physics. Our concern is with the arithmetic of it. It may be stated, however, that 1 lb. of coal can under the most favourable circumstances be made to evaporate from 12 to 16 lbs. of boiling water, the evaporation of each pound being equivalent to 745,800 foot-pounds of mechanical work. At this rate 1 lb. of coal ought to give out from nine to twelve million foot-pounds of work, while in reality no steam-engine ever does so much as two million foot-pounds for a pound of coal, so great is the loss from the want of proper means of utilising the whole work of the combustion of the coal.

Power means the work which an engine can do in a given time. Thus a horse-power (English) is the capability of doing 33,000 foot-pounds of work per minute, or 550 per second. A French horse-power is 75 kilogrammètres per second, and therefore $\frac{75}{550} \times 7{\cdot}23314 = {\cdot}9863$ British horse-power, or 542·5 foot-pounds per second.

This book should be studied, not only by those who are training for professional engineers, architects, and builders, but by every mechanic who seeks to attain the position of a proficient in his art.

The Elements of Plane Geometry for the use of Schools and Colleges. By Richard P. Wright, Teacher of Mathematics in University College School, London, formerly of Queenwood College, Hampshire, with a Preface by T. Archer Hurst, F.R.S., etc., late Professor of Mathematics in University College. Second edition. London: Longmans, Green, Reader, and Dyer.

This is a second edition of a very useful book. The general character of the work is thoroughly practical, putting aside all mere mathematical demonstrations when these are, from the very nature of the proposition, unnecessary. Mr. Hurst's preface sets forth the distinctive features of this treatise by stating that a main object with Euclid appears to have been to show how little need be assumed in geometry, and how much that is obvious as well as obscure may be demonstrated, and that, too, under difficulties which are never encountered and in spite of restrictions which are never imposed.

In this work, on the contrary, advantage is taken of many simple and incontestably true notions, already in the pupil's possession inquiry into their interdependence being postponed, with a view of commencing without delay the all-important part of the subject—the passage with absolute certainty, and in the most direct and simple manner, from geometrical properties which are obvious to others which are less obvious, or not at all so.

The superiority of this mode of procedure for educational purposes will be contested by no one who has observed either the permanently pernicious effects of the discouragement produced by initial vagueness, tediousness, and difficulty, or the permanently beneficial influence of the encouragement arising from early successes, and from the fulfilment of the pupil's natural expectation, that every intellectual effort will be followed by a conscious acquisition of knowledge.

In this second edition Mr. Wright states that in preparing it he has "made use of numerous valuable suggestions and criticisms of eminent geometers. By these means, as well as by the alterations which my own experience as a teacher has induced me to make, I trust that the usefulness of the book has been greatly augmented.

"To render the text-book more serviceable to candidates preparing for matriculation at the University of London, the subject of the *equivalence of figures* has been treated, as in Euclid, without the aid of proportion. Students are therefore recommended to omit Chapters I. to IV., Book III., and after having read the first two books, to proceed at once to Chapter I., Book IV."

We can confidently recommend this book to all students of geometry.

Cassell's New Popular Educator.—This work, which the Chancellor of the Exchequer recently mentioned as being "the first book which he would recommend" to the members of the Halifax Mechanics' Institute, is about to be re-issued. The publishers announce that the demand for the new edition, in its form of weekly numbers and monthly parts, has become so pressing that they have determined to re-issue it at once in its serial form. This new edition was recently completed in six volumes, in which all additions and improvements, demanded by the great advance made in the various departments of knowledge were perfected, and it is now intended that the forthcoming re-issue shall receive all such further revision as the intervening time may have rendered desirable.

MURPHY'S PATENT ROTATORY ENGINES AND PUMPS.

These engines and pumps, the invention of Timothy Murphy, of Clonmel, in the county of Tipperary, Ireland, engineer, are of peculiar construction and arrangement; capable of being worked as a motive-power engine either by steam, compressed air, gases, or water pressure, or of being used as a rotatory pump by simply applying a driving power or motor thereto.

The illustrative drawing shows at fig. 1 a vertical section of a double-action rotatory engine or pump.

A is the outer cylinder, and within it is placed the inner cylinder, formed by the parts C, Z, and W (as shown in transverse section, fig. 2). The axis or shaft M passes through the centre of both the said cylinders, and all round between the inner surface of the outer cylinder A and the outer surface of the inner cylinder, the steam-tight annular free space or chamber B is formed. Z is the part of the inner cylinder which has a free revolving action between C and W within the cylinder A, and is formed on or fastened to the main central shaft M (as shown in fig. 2), and to the outer surface of Z the block or piston L is adjusted which fits steam-tight the said chamber B, and is connected with Z by the arms *a*, *a*, which are formed on or fastened to Z. The inclines E, E, are also formed on or fastened to the surface of Z, leading by an easy ascent from the outer surface of the inner cylinder to or near to the top of the block or piston L, and from the position of the inclines E, E, at each side or face of the piston L a species of cam is formed on the part of the outer surface of the inner cylinder which is formed by Z. Any required number of hinged or sliding valves or stops D are adjusted in the inner surface of the outer cylinder A, and are each formed on or fastened to a corresponding number of shafts P which are made to pass out through one or both ends of the said cylinder (as shown in fig. 2), a corresponding number of arms or levers U being exteriorly fastened to the two cylinders, each arm being provided with a roller Y, adjusted to them by the pins S. The cam *h* is fastened exteriorly to the two cylinders by means of arms on the main shaft M, and as the part of the inner cylinder Z is also fastened on the said shaft M, as before stated, both Z and *h* will maintain the relative positions to each other in which they are placed. The outer cylinder A is fastened to the surfaces C and W of the inner cylinder, and held from revolving by the stops J, J, formed on the bed frame H (as shown in fig 2), as the shaft M revolves either way the hinged or sliding valves or stops D are continually pressed in one after the other against the outer surface of the inner cylinder at either side or face of the block or piston L, and near or at the base of the inclines formed by E, E, and by the action of the inner surface of the cam *h* upon the rollers Y, thereby shutting the chamber B steam-tight by being so pressed into it. The said valves D are pressed out of the chamber B at either side of the piston L by the inclines E, E, which form a species of cam on the part of the inner cylinder formed by Z, to which part the piston L and the shaft M are also attached as before stated. Such a cam as is formed by E, E, can be fastened on the shaft M exteriorly to the two cylinders, and thereby raise or assist in raising the valves D by its action against the rollers Y. The block or piston L is in two parts, and in the opening formed between said parts the two wedge-shaped parts or stop valves O, O, are fitted, and as these parts O, O, are fitted on both sides or faces of the piston L the pressure of the steam will press them tight at either side

between the said two ports of the piston L, and by being so pressed will shut the passage between the said parts of the piston L, and at the same time force the two parts which form the piston L steam-tight both against the inner surface of the outer cylinder, and also against the outer surface of the parts C and W of the inner cylinder. The press ports or stop valves are kept to their places by means of springs at n, n. I, I, are stop valves which form a steam-tight joint between the part of the inner cylinder Z and the piston L; they are also kept to their places by springs. The use of these stop valves is to keep a steam-tight joint between Z and L (as they vary in position) to each other (caused by friction) N, N, are passages passing along from the chamber B at each side of the piston L through the port of the inner cylinder Z, and from Z are extended along the shaft M until they pass out at or near its centre through both ends (as shown in fig. 2). The tubes conveying the steam or other medium to and from the engine are connected with the passages N, N, at the ends of the shaft M by means of socket or other joints, which joints are provided with stuffing boxes, thus allowing the shaft M to revolve on or against the said tubes, and at the same time preserve a steam-tight joint therewith. As the steam or other medium employed enters the chamber B through either of the passages N, N, it will be resisted in its course in said chamber by the hinged or sliding valves or stops D in one direction, and by the block or piston L in the other direction, thereby causing the outer cylinder A and the parts C and W of the inner cylinder to revolve in a contrary direction from the port of the inner cylinder Z; but to form a resistance to the steam A or Z is held stationary (in this case A is held and Z will be revolved by the piston L), thereby causing the shaft M to revolve and give off the power of the engine. H forms a part of the circular surface of Z, and is connected to it at the joint K by the pin T passing through both of them, and H is fitted into the slots or grooves formed in Z at both its ends; the connections both at the ends and at T are so arranged as to allow H to have a free action in and a given distance, and as the part Z is forced round by the piston L the steam will force itself between H and Z at either end of H, and in so doing force back one of the valves G, and force itself along until it is stopped by the other valve G, and when it is so confined between H and Z it will cause H to press out and form a steam-tight joint against the valves or stops D as it revolves with Z against said valves or stops D.

Fig. 2, transverse section of fig. 1. B is the annular free space or chamber formed between the outer circular surface of the inner cylinder and the inner circular surface and two flat surfaces forming the cylinder A. C, Z, and W form the outer circular surface of the inner cylinder, the part Z having a free revolving action between C and W, and being formed on or fastened to the shaft M, which shaft passes through the centre of both the cylinders. The flat surfaces of the cylinder A, t, and W are made steam-tight on the outer circular surface of C and W. T, T, are bushings supporting the outer cylinder A and the circular parts C and W of the inner cylinder on the shaft M, said shaft being free to revolve in said bushings; F is a boss fastened to the end of the cylinder A, and to its end the plate f is bolted. The circular part W of the inner cylinder is pressed against Z by means of set screws in the plate f, thereby making the two joints between C, Z, and W steam-tight. The flat surface G of the cylinder A is formed on the face of the circular part m which fits steam-tight between the two circular surfaces of the two cylinders, and is pressed by the set screw in the plate f against the ends of the hinged or sliding valves or stops, and the end of the block or piston, thereby making both the valves and piston steam-tight against said flat surfaces of the cylinder A in the chamber B. W and m are fitted and held steady within the circular surface of the boss F, the rings S, S, forming a part of m and being pressed forward from the plate f into the stuffing boxes q, q; m can be drawn back out of F by removing the plate f; K, K, are stuffing boxes for the joints formed between C, W, and Z acted upon by the rings R, R, pressed forward from the plate f at one end, and from the flange of the bushing T at the other end by the set screws V, V. The shafts P to which the valves or stops in the chamber B are attached pass out through the stuffing boxes O in the ends of the cylinder A. The cam h is fastened on the shaft M, said cam pressing the said valves or stops into the chamber B through its connection with rollers on the ends of the levers, which levers are fastened on the said shaft P (as shown in fig. 1). The shaft M is fitted in suitable bushings on the bed frame H, J, J, are stops fastened to H which keep the cylinder A and the parts C and W of the inner cylinder from revolving. Y is a wheel fastened on the shaft M which gives off the power of the engine by 1 (as shown). Bushings support the shafts P outside the stuffing boxes. In fig. 3 is shown the mode of reversing the action of the engine; G is a steam-tight chamber, the steam from the boiler passing into same through the tube S; M, M, are ports leading from G through which the steam passes to and from the engine, such ports being connected with the passages N, N, at the ends of the shaft M, by means of tubes as before explained; E is the tube which discharges the steam as it comes from the engine. The lid H is made to slide steam-tight over the ports M, M, and E, and within its sliding surface is a cavity whereby a passage is formed between either of the passages M, M, and E. Thus it will be seen as the steam passes through one of the ports M to the engine it will pass from the engine through the other port M and escape through E, and for the reversing of the engine either way, H is made to slide backwards and forwards across the passages M, M, by means of the rod O, connected with a lever, worked as required by the hand at F, thereby allowing the steam to pass to the engine through either of passages as required.

For single-action engines the reversing apparatus is not required, as the steam will always pass round in the same direction. When the block or piston is connected to the inner circular surface of the inner cylinder, and the hinged or sliding valves or stops are connected to the outer circular surface of the inner cylinder, the steam or other medium employed in the working of the engine is admitted into the annular free space or chamber through a passage in the circular surface of the outer cylinder at one side of the block or piston, after passing round about half the circumference of said cylinders it is allowed to discharge itself through a suitable passage through the outer cylinder.

FIG. 1

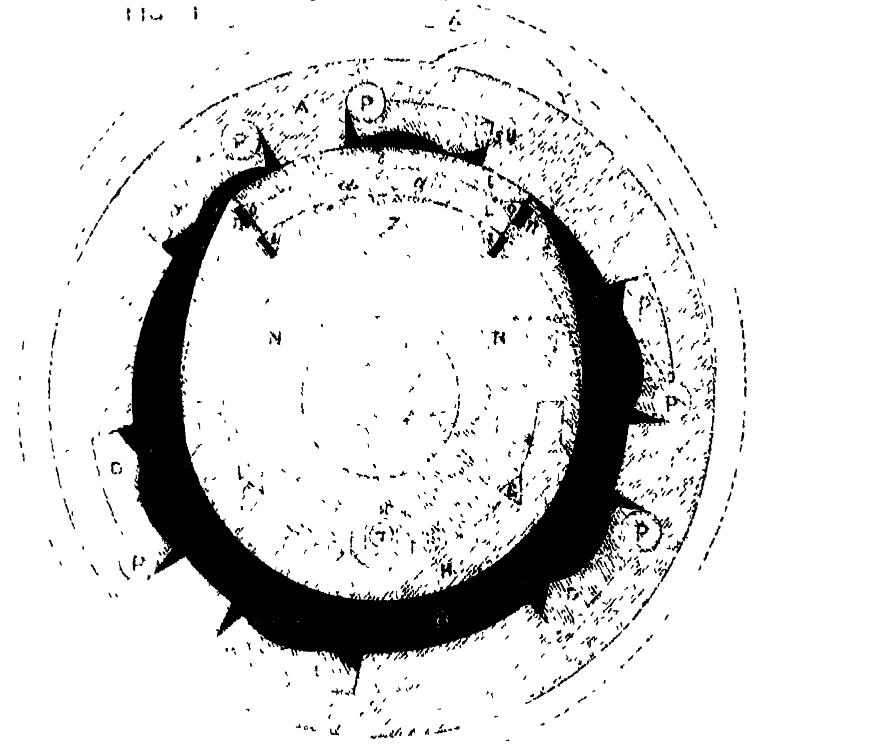
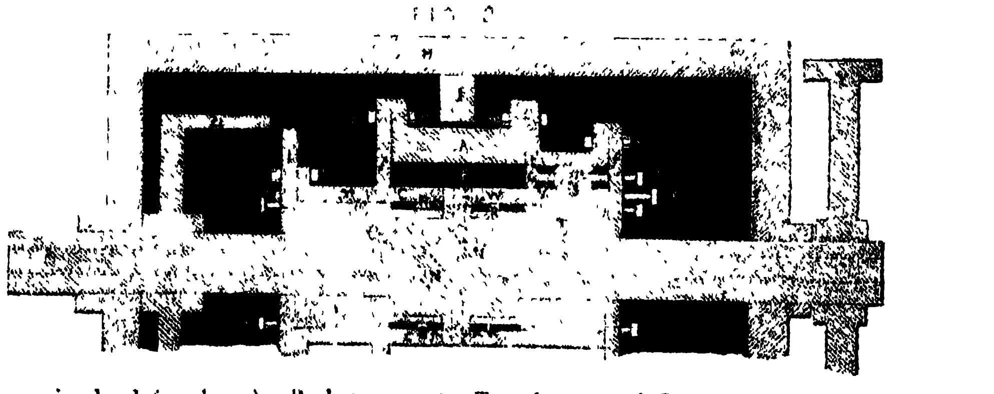


FIG. 2



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MEETINGS DURING THE PRESENT MONTH

THURSDAY 14th —A Paper on Purchase of Railways by the State, by RICHARD BRANDON, Esq., F.R.I.B.A.

THURSDAY 28th.—Report of Patent Law Committee.

R. MARSDEN LATHAM, *Secretary*

Members whose subscriptions are now due will please to forward the same to the Collector, Mr G. A. Stretton, 4, St. Martin's Place, Trafalgar Square, London

Monthly Notices.

Technical Education.—Turners' Company Legal Education and the Patent Laws

THE past month has not produced much that is noteworthy in a scientific point of view. The meetings of the Combined Committee of the Inventors' Institute, the Technical University, and working and professional men, have been continued, but as yet without practical result. We hope Sir Antonio Brady, Mr. Latham, and Mr. Campin, who are workers in the movement, will prevent its falling off to sleep. The Guilds of the City of London have done nothing further in this matter during the past month though we are glad to say that the action of our friend J. Jones's Company (the Turners'), which we chronicled some time ago, has resulted in its bringing into membership such men as Hutton Gregory, Professor Tennant, Sir J. Wentworth, Sir W. Armstrong, Professor Pole, and J. Macgregor. Moreover, this Guild has stepped out of the beaten track, and elected Lady Burdett Coutts a member.

Although general technical education is not moving fast, legal education is up to the front again. Sir Roundell Palmer and his friends are moving for a School of Law, to keep out from the Bar all men of talent and freedom of thought, except they have passed through the curriculum of a new legal university—a measure not calculated to attract men from other walks of life, like many who have adorned our Bar and Bench, and have brought to bear on their duties much useful knowledge acquired by experiences of practical life, which no one simply taken from school to college, and thence translated to the Bar, can possess. As, for the sake of the Patent Laws, we are concerned that men acquainted with practical science should devote themselves to the legal profession, we like not Sir Roundell's scheme, objectionable, moreover, on the broad public ground that it will tend to train up men disposed to perpetuate our present ill-digested, extortionate, tortuous, and uncertain legal system, if system it with propriety can be termed

Recent American Patents.

(From the Scientific American).

Seeder. Thomas I. Pierce and George Pierce, New Providence (Union Post office), Iowa This invention consists in placing oval-shaped buttons on cutaway ends of the conducting spouts to admit of scattering the seed to a greater or less extent, according to the nature of the seed to be deposited

Fence. Russ B Meeker, Sandford's Corners, N.Y.—The post have bases which are broad transversely to the line of the fence, and which enter the ground slightly at their outer extremities, so as to hold them firmly from tipping by the action of strong winds, or by any pressure that animals may bring to bear against them. The rails are interlocked with these posts in such a way that a wedging action is secured with the rails themselves and with the rails and posts, making a firm yet easily erected structure, which may readily be taken apart and replaced whenever desired. In short, it is a portable fence, obviating the need of post-holes, and not disturbed by the action of frost

Knife Cleaner. - William S. Beebe, Joseph T Baynes, and Abraham A. King, West Troy, N.Y This invention consists of a roller cleaner for knives, forks, spoon-handles, and the like, in which one elastic faced roller turns and the other is stationary when the article is pushed in between them, and when it is drawn out the roller which was previously stationary turns and the other is stationary, so that the labour of polishing is divided between the two movements, and can be accomplished with less pressure of the rollers than when the polishing is done on both sides at once, or, if the same pressure is maintained, the work will be done better The invention also consists of a combination of a trough, containing brick-dust or the like, with the lower roller so arranged that the dust will be automatically supplied to the roller.

Earth Scraper. - George W Bayley, of Stuyvesant, N.Y.—We shall be unable, in the absence of diagrams, to give our readers an idea of the details of this novel combination It is, however, a marked improvement in scrapers used for grading roads, lawns, &c., and though quite peculiar not complicated and costly. Its use will lighten the labour of both horses and men in the performance of this class of work.

Brick Machine.—John Treadway, of Haverstraw, N.Y.—This invention consists in certain improvements on a brick machine for which letters-patent were already issued to the same inventor, and consists in the mechanism employed for varying the action of the presser and operating the follower, and in a joint box for the presser-guide.

The Inventors' Institute.

INVENTIONS RELATING TO BUILDINGS.

FEBRUARY 1st, 1872.—Sir Antonio Brady, Chairman of Council, in the chair.

The CHAIRMAN stated that, as the present meeting was one devoted to a further discussion of Mr. B. Fletcher's paper, read before the Institute on the 4th of January, he considered it desirable for Mr. Fletcher to reopen the discussion, when he could make any additional observations he might think desirable. He would, therefore, call on that gentleman to first address them.

In response to this invitation, Mr. FLETCHER said he could not help remarking that there was a love of *home* even amongst the most dissolute of Englishmen, and expatiated on the desirability of making the homes of the people as complete as possible with regard to all the conveniences and sanitary requirements of life. Mr. Fletcher exhibited drawings and models in order to exemplify his observations. The important subject of sanitary arrangements was fully treated of, Mr Fletcher stating that the main sewers of this city and other large towns were nothing more nor less than elongated cesspools, and that in ventilating them the impure gases rose up and filled the atmosphere of our streets with their noxious exhalations; yet if not ventilated the gases were forced into our habitations through the drains. How to avoid this afforded a field for inventive genius. It was said when cesspools were abolished, "Use plenty of water and send all into the river, and there is an end of it," but we know now to our cost such is not the case. Mr. Fletcher then exposed the defects in existing traps. Two of Mansergh's external house-protecting drain-traps were exhibited, which, being ventilated at the side, can communicate with the pipe running up the wall of house. In summing up the results, Mr. Fletcher said he thought the things to be aimed at were plenty of ventilation; of drainage improvements in existing valve-closets; some means whereby evaporation should not take place to such extent that traps in areas and exposed places should cease to effect the purposes for which they are intended, and easy ventilation in dwellings, without draught. He also advocated a constant water supply, and in urging increased exertions in the matter of sanitary reform, concluded his paper in these words:—If the physician is more than armies to the public weal, how much greater than he must be that man who, by his inventions, limits or prevents the necessity of calling in the physician!

The discussion was then opened by

Dr. LIDDLE, who remarked that our present system of main drainage ought to have been entirely altered when our new scheme was adopted; for the inclination of the sewers was now out of accord with the auxiliary drainage from the houses. With regard to the houses of the poor, a subject in which he felt much interest, he would suggest that their proper sanitary condition should be provided for by an Act of Parliament requiring the certification of such condition before being inhabited. He knew a house in Whitechapel where the legal requirements of 100 square feet of space at back of house, to supplement insufficient light and air in front, had been most ingeniously evaded. Two houses were turned into one by making an opening between them, and in that state presented to the examination of the local board. They were afterwards separated into two houses, and so let as separate dwellings. The sewerage has now to be examined and certified; the other sanitary arrangements should be treated in the same way.

Mr. PARKER RHODES knew of a locality where the builder had done everything for the comfort of the inmates, but all good effect had been frustrated by the action of the local board, which, though it made the inhabitants pay rates, would not take charge of the road. There was no repairing, no sweeping, no attention whatever. He thought the Government ought to appoint professional inspectors, and abolish the action of vestry boards.

Professor KERR, in an able speech, stated that he could not agree that the New Building Act ought to give the powers required as to the sanitary arrangements. The Metropolitan Board had now so much work to do that it ought not to be saddled with a new and difficult one. As he saw Mr. Ransome in the room, he wished to ask if his stone were waterproof, as that would greatly enhance its value. It was an easy thing to talk about scientific invention being developed, but it was quite another thing to get it satisfactorily carried out. As regarded the sanitary requirements of the present day, he would observe that we had become very exacting in such matters. He might say there was an extreme fastidiousness on the subject. Yet when good ventilators are provided we find the ladies stop them up. Although we had provided an elaborate system of drainage, yet we went on concocting bad vapours in the sewers, which find their way into our streets and houses. The alarm occasioned by the illness of a distinguished personage was, however, most exaggerated and uncalled for, for English houses were amongst the best in the world. At the same time a man ought not to be poisoned by a bad house. The Professor criticised the plan and construction of certain dwellings for the poor in Glasgow, and objected to their arrangements. He thought Mr. Fletcher's plans were good, according to generally received ideas, but he considered one large room the best for a poor family. Screens and partitions they would provide for themselves. If rooms are divided into distinct compartments, they will be let out to lodgers instead of being retained for family use. As to ventilators, dust-shafts, &c., the less complicated these arrangements were made the better—the poor do not want them, and do not know how to use them. Anything which was to be used by the poor must be of a rough-and-ready kind. There was excellent opportunity for inventors to improve dwellings, whether for the rich or poor. He considered it desirable to have two tubes for ventilating the water-closets, divided into upcast and downcast, like Watson's ventilator.

Mr CHESTER thought there should be a general sweeping measure of legislation, applicable to all buildings.

Dr. FOWLER referred to the overcrowding in the houses of the poor. He had seen eleven people in one room. His experience as District Medical Officer of the East London Union led him to conclude that amongst other defects the chief were water, both in quantity and quality, and the state of the water-closets. Measures adopted to remedy their houses must be simple and effective. Inspection by skilled officers must be more frequent, and instead of once in six weeks as at present, it should be at least once a week.

Mr. EDWARD HALL, F.S.A., thought dust a fertile cause of disease, and advocated its removal every day, comparing Paris with London in this respect. He also remarked that houses should be constructed so as to keep out noises as far as possible. He knew a mansion which was rendered disagreeable to live in, in consequence of its being very defective in this respect.

Dr. PLATT stated that germs of disease emanated from sewage, and, however good the traps, it was impossible, with the present construction, to prevent gases from getting into the house. He also spoke of ventilation, and the difficulty of getting either rich or poor to adopt measures to secure proper ventilation.

Mr. FLETCHER was then called upon to reply, which he did.

The CHAIRMAN, in summing up, alluded to the valuable suggestions made on the subject, and contended that the way of making sewers now adopted was bad—the gases emitted therefrom being the cause of zymotic diseases which are preventible. He also advocated constant water supply, and in referring to experiments made by Dr. Calvert to test so-called disinfectants, stated many had turned out to be useless; also, that boiling articles of apparel in water had little or no effect in purifying. Many so-called disinfectants were found to be new sources of poisoning. Amendment was required in rich men's houses as well as in those of the poor.

Mr. CAMPIN, in proposing a vote of thanks to the Chairman, said at that late hour he would not inflict a speech of his on the meeting, and would merely remark that the recommendation of Dr. Liddle seemed to be misapprehended by Professor Kerr. He did not understand Dr. Liddle to desire that the Metropolitan Board be required to examine the sanitary condition of houses before they could legally be inhabited; it was the vestries and local boards that gentleman wished should be required to do it. With regard to the shortcomings of the local boards, great as they were, they formed no sufficient argument for their abolition and transfer of their powers to professional men working under the centralisation system. The ratepayers elected the local boards, let them look to the matters themselves, and put the right men in the right place, aided by more professional assistance if need be. He then moved a vote of thanks to the Chairman and Mr. Fletcher, which was seconded by Mr. F. H. Varley and supported by Mr. M. M. Harris and Mr. Carttar; this being carried by acclamation, the meeting concluded.

NEW SAFETY RAILWAY SYSTEM.

FEBRUARY 17th, 1872.—Mr. F. W. Campin, Barrister-at-law, Member of the Council, in the chair.

Mr. PARKER RHODES commenced his paper by stating that he had been recently reminded by a scientific French nobleman that her Majesty the Queen expressed, on the occasion of a calamitous railway accident, the wish that one day her subjects could travel with the same safety as is insured to the Royal train. He then remarked that in offering the three systems combined in the models he exhibited, it devolved on him to show how far that Royal wish had been considered, and how far he had provided against railway accidents for the safety of the public. After these prefatory statements, Mr. Parker Rhodes treated exhaustively of the present system and its shortcomings, and recommended for adoption one which he illustrated by models exhibited at the meeting, principal points of which were self-acting friction breaks, consisting of whole quadrant pieces put on by a system of levers connected with the buffers, so that collision would cause those breaks to be put on instanter; also suspended seats for passengers, and improved means of communication by signal-flaps at top of carriage, which are raised by action of the connectors worked by handles, so as to give warning to the guard; and other ancillary arrangements.

After the paper had been read, the CHAIRMAN moved a vote of thanks to Mr. Parker Rhodes, which was passed by acclamation, when those present were invited to discuss the subject.

Mr. FAULDRY remarked that he feared that it would be found the whole strain would be thrown on the axles, and they would be broken.

Mr. TOOTH considered the models possessed features entirely new, and of a very valuable character, though, Mr. Parker Rhodes not being an engineer, they were possibly not presented in the most practical form.

The discussion was continued by Mr. SHUTE, Mr. CLAY, and by Mr. MCNAIR, who referred to the breaks used on the Victoria branch of the North London, which comprised a very efficient system of hydraulic mechanism applied to every carriage, with as many handles as half the number of passengers.

Mr. CARTTAR and others pointed out some advantages of Mr. Parker Rhodes' plans.

Mr. PARKER RHODES replied, showing that all reasonable contingencies might be met by the proposed system, though he admitted its details would need modification if adopted in practice.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

JANUARY 23, 1872. T. Hawksley, Esq., President, in the chair.—The paper read was on the construction of "The Somerset Dock at Malta," by Mr. Charles Andrews, M. Inst. C.E.

The author referred in the first place to the original dockyard at Malta, which belonged to the Knights of St. John, and was commenced under the administration of the Grand Master Emmanuel Pinto, in 1765. The island came into the final possession of the British in 1814, when steps were taken to improve the dockyard, a small graving dock being then commenced on the east side of Dockyard Creek; but this had to be abandoned, on account of the character of the rock and of the leakage of sea-water, and was subsequently converted into a boat-slip.

The next attempt was made in 1841, when the present Dock No. 1, or Old Dock, was constructed at the head of the Dockyard Creek. The foundation-stone was laid by Sir Patrick Stuart, on the 28th of June, 1844, and the dock was opened on the 5th of September, 1848, when for the first time a British vessel of war was refitted for sea service at Malta. It was designed by the late Mr. W. Scamp, M Inst. C.E., and was of the following dimensions: Length over all, 310 feet; length on the floor, 230 feet; width between the copings, 82 feet; depth on the cill, 23 feet; and depth on the floor, 25 feet. The cost of this work was about £60,000. In 1856 this dock was lengthened 294 feet at the head, making the total length on the floor 524 feet, and the cill was lowered 2 feet, while a sliding caisson was put in at the middle so as to form two separate docks if required. The cost of these works amounted to about £90,000.

The requirements of an iron-clad fleet rendered it imperative, however, that a still larger dock should be constructed, and the Admiralty were led to negotiate with the local Government for the possession of the French Creek, which at the time was fully occupied by the Maltese merchant shipping. In order to arrange for the transfer of this trade, the head of the Great Harbour was extended about 88 acres; £250,000 being expended on this work, from the designs of Mr. Scamp. A graving dock was commenced in 1862, in the New Harbour Extension; but at a very early stage strong local opposition was encountered, and as great difference of opinion existed as to other sites the Lords of the Admiralty visited the island in September, 1864, to decide the question. The several sites were examined by Lieut.-Colonel Clarke, R.E., C.B., Assoc. Inst. C.E., the Director of Works to the Admiralty, who advised the abandonment of the dock in the Harbour Extension, and selected a site in the French Creek for the dock which was the subject of the present communication. The works were commenced in 1865, from Colonel Clarke's designs, under the superintendence of the author. The length on the floor was 428 feet; the length over all was 468 feet; the width of the floor was 42 feet 6 inches; the width between the copings was 104 feet, and the width of the entrance was 83 feet. The depth of the invert, floor, and entrance below the average sea level was 33 feet 6 inches. The cost of the dock inclusive of the caisson was about £120,000. The entrance cost £80,000, exclusive of clearing the rock from the site. The work was partly executed by local contractors and partly by day-work, under the direction of the author; and the dock was opened on the 16th February, 1871.

In regard to the preliminary works, excavations, etc., it was remarked that the site was occupied by an old fortification, the Demi-Bastion St. Raphael, and formed a plateau 55 feet above the sea level, bounded on the margin of the creek by a bastion wall 72 feet high, and on the side adjoining the dockyard by an elevated road. There being no communication between the two sides of this road, a tunnel 90 feet in length was driven through the solid rock, to convey the excavated materials to barges for removal to sea. A second tunnel was also made, and 250 cubic yards of rock were removed daily. When the site was sufficiently cleared to the wharf level, 6 feet above the sea, the dock pit was proceeded with. A trial shaft had been sunk to ascertain the water-bearing character of the rock; but no fissures were met with, and the water arising from slight cracks and partings only amounted to about four gallons per minute. An 8 H.P. engine, with one of Gwynne's centrifugal pumps, was put into use, and a 10 H.P. engine was held in reserve. A large temporary pump well was formed 40 feet outside the caisson groove, for receiving two 20-inch barrel pumps, to be worked by a 35 H.P. marine engine. At this time the leakage from the sea was 300 gallons per minute, which was easily kept down by one small portable engine. The 35 H.P. engine being ready by the end of February, 1867, the water was kept down to 34 feet below the sea level without the other pumps. In the following month the pump well was 43 feet deep, and a great increase of water took place. An additional engine of 12 H.P. was used, and another of 20 H.P. was ready in the following May, the latter being attached to one of Murray's chain pumps, capable of discharging 1600 gallons per minute. In July the flow was gauged, and the total quantity was found to be 5725 gallons per minute. The cost of pumping was much increased on account of the scarcity of fresh water, Dr. Normandy's condensing machines having to be used. The temporary pump well in the entrance, from which the greatest leakage proceeded, was filled up with concrete; and another was sunk upon the wharf, 20 feet behind the coping, and was worked by the 35 H.P. marine engine. In August the site of the invert and caisson groove was excavated for setting the masonry. The largest fissures were found near the centre line of the dock, 50 feet within the caisson. Two lines of 12-inch cast-iron pipes were laid below the masonry, to lead the water from the fissures to the pumps. The outlets were provided with vertical disc-valves with screw adjustments. In February, 1868, the removal of the rock round the main fissures (which had been left 31 feet below the sea until the invert was set) was again proceeded with, but the discharge under so great a head continued to increase, and the engines were again overpowered. Wedges were then driven in, but new openings were formed, owing to the rotten nature of the rock. A 20 H.P. horizontal marine engine was obtained to work a centrifugal pump, and two additional lines of 12-inch pipes were laid under the floor to draw the water from the main fissure. The pumping power now available amounted to 113 H.P., while the leakage was 7500 gallons per minute. The labour in keeping so many engines in repair, and the time that would have been occupied in obtaining additional pumping power from England, induced the author to adopt the following expedient:—The water was allowed to rise to 28 feet, to relieve the pressure, and a stage was formed over the main fissure. A guide box was then lowered upon the fissure, and within the box a long chisel was worked by a ringing engine, by which means a pit was cut in the rock to a level of 43 feet 9 inches below the sea. This, being levelled, received a slab of limestone, 6 feet 6 inches by 3 feet 6 inches by 1 foot 5 inches, having a thick bed of puzzuolana under it secured to the slab. This being carefully set, the edges were filled in with wedges, and the leakage passed freely below the masonry to the pump wells. In July the masonry was sufficiently set to permit of the partial closing, by means of the screws, of the outlet valves which were ultimately successively closed, and on the completion of the works the leakage was less than seven gallons per minute.

With respect to the masonry, mortar, etc., it being desirable that the dock should be available as soon as possible, the setting of the masonry was conducted, with that view, the caisson groove and camber, the invert, and 40 feet of the floor being completed first. The floor stones were set by a low traveller, and on these courses a staging was formed, 48 feet high, to receiving two of Taylor's steam travellers, which continued the masonry to nearly the water line, when ordinary sheers were used. The inner lining of the dock was formed of the hard, crystalline limestone of the island, in blocks varying from three tons to eight tons in weight, the backing being of an inferior quality of the same stone. The lime burnt on the works cost 4s. 6d. per cubic yard; it was obtained from the best crystalline limestone, and was not hydraulic. The puzzuolana was supplied from the caves of St. Paul, Civitá Vecchia, and weighed 70 lbs. per cubic foot, its average price being 7d. The mortar weighed about 1 cwt. per cubic foot, but was inferior to Portland cement for water-tight purposes. A series of experiments was made upon the strength of the puzzuolana mortar, of which the details were given in an appendix to the paper.

As to the excavation of the entrance, the centre line of the dock formed an angle of 28° with the old wharf line of the French Creek. The north entrance wall was thus 345 feet in length from the outer invert, and the south wall 136 feet, the skew width across being 240 feet. To enclose this within a coffer-dam, to enable the rock to be removed to the depth of 33 feet 6 inches, would have been very expensive. The dam was therefore placed on the sloping rock, where its surface was about half that depth. The rock was then excavated in the usual manner up to the dam. It was now determined to excavate the rock under the dam, and twenty-three drifts were driven in the rock. These drifts were connected by cross-cuts, leaving the dam and the bed of the creek supported on a series of pillars. Upon the completion of the caisson, the sea was admitted, the dam was removed, and the mud was dredged from the rock. A series of 5-inch holes was drilled from a floating stage into the pillars, into which charges in tin cylinders were placed, and fired by a Wheatstone exploder. The rock was then slung by divers, and hoisted by steam power.

The caisson was constructed by the Butterley Iron Company, and was upon the sliding principle, a camber for its reception being provided on the east side of the entrance. The caisson was 83 feet long, 41 feet high, and 12 feet 4 inches wide. The lower water-tight deck was 21 feet below the top, and under this the water passed freely, the ends being open. The upper deck had a vertical movement of 2 feet, and the hand-railing was connected with it in such a manner that it fell upon the deck when the latter was lowered. The deck was supported by seven pairs of vertical legs, hinged at the top to two longitudinal girders, which carried the cross girders of the deck, and moved longitudinally at the bottom, like pendulums, but supported upon the second deck on two rollers, attached to them. The rollers were connected by two T irons, which, on being pushed or pulled from the end, caused the legs to assume an inclined position when the deck had to be lowered, or a vertical position when it had to be raised. The draw bars were attached at one end to two endless chains, working on each side of the camber, set in motion by gearing, driven by shafting from the drainage engine. The flotation of the caisson was adjusted by 85 tons of water ballast beneath the upper deck, which was increased or diminished as required.

The pumping machinery for emptying the dock was supplied by Messrs. J. and E. A. Gwynne and Co., and consisted of two 60-h.p. high pressure horizontal engines, working three centrifugal pumps, by means of a large spur wheel, gearing into three pinions keyed upon the three pump spindles. The pumps were all driven together when the dock was full, but after the water was lowered 11 feet one of the pinions was thrown out of gear, and at 23 feet another was detached, the pumping being completed with one only. The

quantity of water pumped out was 7,077,115 gallons in four hours and three-quarters. The drainage of the dock while in use was effected by a 30-h.p. engine, which also worked the machinery for the caisson, and the hydraulic pump for the penstocks.

On January 30—Joseph Cubitt, Esq., Vice-President, in the chair—the paper read was "On the Value of Water, and its Storage and Distribution in Southern India," by Mr. George Gordon, M. Inst. C.E.

After premising that the object of the paper was to deal with the probable results of works of irrigation as commercial speculations, and not with the undoubted advantages to the people and the indirect profits to the Government accruing from such undertakings, the author proceeded to give an account of the ancient native and the modern systems, under the two heads of Tank and Channel Irrigation.

The existing Tank Irrigation was chiefly ancient, and comprised innumerable tanks of all sizes, from what might be termed lakes downwards. These might be divided into three classes: 1° Those formed by the closing of the passage of a considerable river through a narrow gorge, in a range of hills, by means of a high dam or "bund." 2° Those formed in the plains, by embankments carried across the drainage of the country, and impounding the water of one or more streams; these tanks being often of great superficial area, but shallow. 3° Tanks which might be considered intermediate between the other two, having in general a greater length of dam than the first, and a greater depth of water than the second. Few examples of the first kind remained entire. A description was given of the ruined Mudduk Masoor Tank, one of this class situated on the borders of Dharwar and Mysore, of which the following were the principal dimensions. Length of the main bund on the crest, 550 yards; present height from 90 feet to 108 feet; width at the base, from 915 feet to 1100 feet; area of the lake at 90 feet depth, 40 square miles; contents about 1400 million cubic yards of water. The area of the drainage basin, which was on the inner slopes of the Western Ghâts, was 500 square miles. The author was engaged on a proposed restoration of this tank, but it was found that the present average rainfall would not suffice to fill much more than one-half of its ancient basin, and it was suggested that the depth should be reduced from 90 to 70 feet. This diminution in the supply was supposed to be attributable partly to the diminished rainfall, and partly to the construction of small tanks on some of the feeders at a date subsequent to the completion of the Great Tank, which was assigned, by tradition, to the fourteenth or fifteenth century. The main bund was supplemented by two smaller ones, placed on saddles at some distance from it, in the range of hills, and it was by the breaching of one of these that the tank was ruined, as the principal embankment remained entire. There were no traces of a waste weir or bye-wash of any kind. The second and third classes of tanks were then described, some ancient ones of great dimensions being noticed, such as the ruined Poonairy Tank, in the Trichinopoly District, of which the embankment was twenty miles in length and the Veeranum Tank, still in action, with a bund twelve miles long.

Under the head of Channel Irrigation, it was stated that only rivers of the larger class, which had a continuous flow for several months, were available for extensive irrigation projects. The smaller rivers were merely torrents, which quickly carried off heavy falls of rain, and then became dry again. The water, however, was in many cases intercepted by chains of tanks, of the second or third class, built across these torrents.

The deltas of large rivers, being the most easily irrigated lands, had been so treated for ages, and the works had been much extended and improved under the British Government, by the construction, by their able engineers, of permanent weirs of great lengths, at the heads of the deltas, such weirs being built on the sandy beds of wide rivers subject to heavy floods. This seemed to have been beyond the skill of the ancient native rulers. They however built many weirs on the large rivers in the middle part of their courses; the situations being skilfully chosen, but the construction was rude and imperfect. They were generally built on a reef of rocks, with loose rubble, faced with large blocks of granite laid dry, and sometimes fastened with iron clamps. The modern weirs in similar situations were of masonry, with a vertical or slightly battering face on the down-stream side, and with heavy copings. In rivers having sandy beds, it was usual to build the body of the weir on a foundation of brick wells, sunk to the low-water level, and filled with concrete. On the lower side there was an apron, having a slope of 1 in 12 from the crest, with a toe wall; and if the slope was long, intermediate walls were also built on wells, and below all there was a broad layer of rough rubble of large dimensions.

The ancient irrigation channels were generally defective in design, being too small, and having much too great a fall. In consequence of these channels being so near the river, they irrigated only a narrow strip of land; and the current being too great, excessive annual repairs were required. This system necessitated numerous offtakes from the river, involving the expense of many weirs, and a great aggregate length of unproductive channel, from the offtake to the point where the channel reached such a level as to command the surface of the country. On the other hand, a canal of large dimensions, taken off from one head, having a slower current and less fall, would soon so gain on the level of the river, that it would reach districts remote from it, and consequently more in need of artificial supplies of water; and it would also command a much larger extent of country than it could supply entirely with water. This was an advantage, because it would be many years before a district could be completely changed from dry to wet cultivation, as it would require to have its population trebled. It also afforded means of assisting dry crops in years of drought, and thus preventing famine. In many districts complete failure of the crops now grown occurred every few years, and a good crop was a rare occurrence. There should, therefore, be facilities for completely irrigating detached areas at considerable intervals, and of giving occasional irrigation to dry crops.

Distribution was effected from the second class of tanks directly, by means of sluices in the bund. From the third, and more especially from the first class, it was commonly effected indirectly; thus, the natural channels of the river or rivers, which had been dammed to form the tank, were used to carry part of the water for irrigation, weirs being built across them at suitable places, and artificial channels taken off from above them. By these means the surplus of the water, which was generally wastefully used by the ryots, was saved, being collected by drainage into the stream, and redistributed at the next weir. Distribution was most economically effected from a canal, when the latter ran along a ridge; but as this could rarely be accomplished in the case of a canal taken off from a main drainage, it was next best effected by leading the main distribution channels down the ridges crossed by the canal. Distribution could be carried out in the Ceded Districts for 5s. per acre, including sluices in the main canal, and all necessary road and water crossings, but excluding the cost of terracing the land to prepare it for wet cultivation, this being done by the occupier. The nature of the ground was such, that, in the districts to which the paper referred, the drainage was effected naturally, no works being required for that purpose beyond small open trenches in the rice-fields.

The value of water to the cultivator was shown first, by contrasting the yield of dry crops with that of rice and sugar cane, from actual experiments.

With respect to the cost of tanks, the author gave some figures to show, that the construction of flat country tanks of the second class, or even of the third class, would offer a very doubtful return, although in some cases it might pay the cultivators to construct them. Great profits had been made by Government in several cases, by restoring or repairing tanks, and also channels which had become ruined, such net profits amounting to from 10 per cent. to 45 per cent., and in one instance, which was cited, to 250 per cent. The construction of large storage reservoirs would, the author considered, return a very large per centage on the outlay. Although none of large capacity had yet been constructed, it appeared probable that, in the most favourable localities, 7000 cubic yards of water could be stored for £1, and in others 4250 cubic yards, while the restoration (in part) of the ancient tank of Mudduk Masoor, already mentioned, would yield 9600 cubic yards per £1.

The loss by evaporation in the reservoirs of 70 feet and upwards in depth would vary with their depth, and the time in which they were emptied. It was found, by observations of the evaporation in the locality of three proposed reservoirs, to vary from 5 per cent. to 7½ per cent. of their contents. A further loss from the same source would occur in the passage of the water to the country to be irrigated, varying of course with the distance, &c. For the purposes of calculation, the correction for evaporation was assumed at 12 per cent., and the quantity of water required for the cultivation of an acre of rice at 5000 cubic yards. At the most unfavourable rate of storage, (4250 cubic yards per £1, and adding, as in the case of the channel works, 25 per cent. for interest during construction,) 5400 cubic yards per £1, the prime cost after all deductions, would be £1 9s. 5d. per acre, for giving a second crop of rice, or a crop of sugar cane; while the cost at the rate at which the restoration of the Mudduk Tank was estimated would be 14s. 10d. per acre. Reference to a table in the paper showed that an outlay of £1 9s. 5d. would yield a net return of about £1 1s. This allowed a large margin for the construction of reservoirs in still less favourable situations than the least favourable one which the author had examined. This statement supposed the reservoir to be constructed in addition to a system of distribution works already existing. The author had excluded the subject of navigation from his paper, as no general rule could be laid down, as to whether it could or could not be economically combined with irrigation. With regard to the large and very remunerative works in the Kistna, Godavery, and Tanjore Deltas, it was mentioned that the works in the latter yielded, after deducting repairs and 5 per cent. on the capital, 23½ per cent direct profit, and those on the Godavery from 50 per cent. to 60 per cent. These examples were only incidentally alluded to, because all the deltas were so occupied as to offer no opportunity for new undertakings on a large scale, while in other districts such enterprises would necessarily be more expensive.

The author submitted the following conclusions:—1st. That irrigation would benefit the cultivator to such an extent as to enable him to pay a water rate equal to two-thirds of the increased value of his crop, and still leave his own profits from 50 per cent. to 400 per cent. in excess of those derived from dry cultivation. 2nd. That the most profitable application of capital would be found in the construction of storage reservoirs as an addition to distribution works already in existence, and that these would yield a net return of 46 per cent., after paying one-third of the gross revenue to the existing works, and increasing the revenue of such works by 4½ per cent. 3rd. That the arbitrary water-rate of 12s. per acre was, on the data assumed by Government, insufficient to yield a fair return directly on the average of new irrigation works, unless these included the storage of water for a second crop. 4th. That the profitable employment of capital in irrigation depended chiefly on the recognition of the principle, that the water rate should be fixed with reference to the value of the crop produced by and the cost of the

works in each case, and that otherwise many very beneficial projects would remain unexecuted.

At the meeting of the institution held on Tuesday, the 6th of February—Mr. T. E. Harrison, Vice-President, in the chair—thirty candidates were balloted for and declared to be duly elected, including eight members, viz., Mr. Howard Aston Allport, Inspecting Engineer, Bedford and Northampton Railway, Bedford; Mr. William Barrington, Limerick; Mr. John Elliott, Chief Inspector of Machinery and Traction on the Florence Railway, Leghorn; Mr. William John Galwey, District Engineer, East Indian Railway; Mr. George Henry Hill, Manchester; Mr. George Robert Jebb, Chief Engineer of the Shropshire Union Railways and Canals; Mr. Alexander M'Donnell, M.A., Locomotive Engineer of the Great Southern and Western (of Ireland) Railway; and Mr Daniel Pryce, Resident Engineer of part of the Great Eastern Railway Company's Metropolitan Extensions. Twenty-two gentlemen were elected associates viz., Mr. John Walker Balmain, Government Reclamation Works, Bombay; Mr. James William Butler, Willesden; Mr. Samuel Carrington, Engineering Staff of the East Indian Railway; Mr Henry Chapman, Paris; Mr. John Cleghorn, late Secretary of the North Eastern Railway Company; Mr. Alfred Dawson, Westminster; Mr. Whately Eliot, Weymouth; Mr. Richard Hammersley Heenan, Executive Engineer of the Bhawulpore State; Colonel James Macnaghten Hogg, M.P., Chairman of the Metropolitan Board of Works; Mr. Elihu Henry Oliver, Shanghai; Mr Henry Blackburn Parry, Assistant Engineer, P.W.D. of India; Mr. Frederic Molesworth Pied, Engineer, Madras Railway Company; Mr. John Phillips, Holland St., Blackfriars; Mr. Gilbert Richard Redgrave, Hyde Park Gate; Mr Henry Francis Ross, Chief Engineer of the Iquique and La Noria Railway, Peru; Mr. Albert Marcius Silber, Wood Street; Mr Charles Tomlinson, Rotherham; Mr. Henry Tomlinson, Cambridge; Mr. George William Usill, Stud. Inst. C.E., Chesterfield; Mr. Rienzi Gresman Walton, Acting Executive Engineer, Bombay Municipality; Mr. George Herbert West, M.A., Wimpole Street; and Mr. William Henry White, Engineer to the Oxford Local Board.

The council reported that, acting under the provisions of Sect. III. of the bye-laws, they had transferred Messrs Horace Bell and Thomas Codrington from the class of Associate to that of Member; also that, in accordance with Sect. IV., they had admitted the following candidates students of the institution: Messrs. Frederick George Bannister, Edward Ernest Brice, Alfred Edward Carey, Griffith Nathaniel Cox, Martin William Ffolkes, Edgar Giberne, John Hunter Jones, and William Beswick Myers.

FEBRUARY 13, 1872. G. Willoughby Hemans, Esq., Vice-President, in the chair.—The paper read gave "An Account of the Bridge over the Gorai River, on the Goalundo Extension of the Eastern Bengal Railway," by Mr. Bradford Leslie, M. Inst C.E. It was remarked that of the numerous deltaic branches through which the water of the Ganges flowed to the sea, the Gorai was the largest and most important. It was more uniformly deep than the Ganges proper, and towards the end of the dry season, when the water of the main stream was kept back by the rising of the Burhampooter, it discharged a greater body of water. The Gorai was also the main navigable channel through which, in the dry season, the produce of the upper districts was brought down to Calcutta. At the site of the bridge the river was about 1000 feet wide and forty feet deep in the dry season, with a current of three miles an hour. The width was increased to 1600 feet in the rainy season, when the water rose twenty-eight feet, and the velocity of the stream was nearly five miles an hour, causing the bed of the river to be scoured twenty-four feet, so that the depth during floods was upwards of ninety feet. On the west side of the river there was a sand-bank, 500 feet wide, which was dry in the cold season, but had about thirty feet of water over it during the floods. This part was crossed by a screw pile viaduct of nine and a-half spans, of forty-six feet three inches each. The deep water channel was on the east side of the river; and this was crossed by the main bridge, which consisted of seven spans, of 185 feet each from centre to centre of the piers. Each pier was composed of two cylinders, placed thirty-seven feet three inches apart from centre to centre, so as to be wide enough for the superstructure for a double line of way; but at present only the northern half of the piers was occupied by a single line. The first cylinders were sunk on the west side, to a depth of eighty feet below low water, or about forty feet into the bed of the river; but as the effect of the floods indicated the advisability of going to a somewhat greater depth, the remaining cylinders on the east side were sunk to a depth of ninety-eight feet below low water. Each cylinder had a wrought-iron base, thirty and a-half feet in height, fourteen feet in diameter at the bottom, and thirteen feet four inches in diameter at the top, above which there was a cast-iron taper piece, or cone, reducing the diameter of the upper portion, which was also of cast-iron, to ten feet. As the cylinders were erected a ring of brickwork, fifteen inches thick, was built on inside diaphragms; and when finished the cylinders were filled with concrete and brickwork. The two cylinders of each pier were connected at the top by two wrought-iron cross girders, which carried the main girders of the superstructure, at a height of twenty-two feet above high water, or fifty feet above low water. The main girders were placed thirteen feet six inches apart, and were solid beams twelve feet six inches deep between the top and bottom tables, which were three feet wide. Transverse flooring girders carried longitudinal baulks of timber, to which bridge rails were fixed. The girders were connected, though not so as to transmit the strain as in continuous girders, over the second, fourth, fifth and seventh piers, while they were free to move from expansion and contraction due to variations of temperature, on the first, third, sixth, and eighth piers, on which the bed-plates were covered with brass plates to diminish friction. As the rails moved with the girders, a scarf joint in the rails admitted of the adjustment consequent on the expansion or contraction.

Owing to the treacherous nature of the bed of the river, the great depth of the water, and the strength of the stream, it would have been very difficult to erect a staging for sinking the cylinders; and even if this had been possible in the dry season, it would have been necessary to remove the staging and to stop the work during the floods. It was, therefore, decided to sink the cylinders from a pair of pontoons moored at the site of the piers, and connected together by an intermediate platform, having openings in it corresponding to the distance apart of the two cylinders of a pier, and hinged to the pontoons in such a manner as to admit of independent vertical motion in them, though not allowing any freedom of motion in a horizontal direction. The pontoons were furnished with two powerful travelling cranes, thirty-seven feet span and twenty-five feet hoist, which commanded the whole space between the pontoons and a portion of the deck of each. One of the pontoons was also fitted with a twenty horse-power engine, for driving two thirteen-inch centrifugal pumps, and with a pair of air-compressing and exhausting pumps, for working the appliances used for sinking the cylinders. The pontoons were moored by chain cables—one laid from the bow and one from the stern of each pontoon in an oblique direction, so that the four moorings formed in plan a St. Andrew's cross.

In pitching the cylinders, after the three lower rings had been erected on baulks of timber laid across the opening of the platform, and the brickwork had been built on the diaphragm of the second ring, a temporary bottom was fitted to the third ring. This consisted of an inverted cone of taper pine-wood staves, butting at their upper ends against an inverted angle iron and at their lower ends against a central cast-iron plug, and made perfectly tight by caulking on the under side. When the three lower rings of each cylinder with the temporary bottom, weighing together thirty tons, had been lifted by the traveller, the timber baulks were removed, and the mass was then lowered eight feet into the water. For controlling and adjusting the position of the cylinder as it went down, three moorings were attached to it by means of a sling chain or girdle passed round the cylinder nine feet above the bottom. These moorings in plan formed the figure of the letter Y, the foot of the letter representing the up-stream anchor, the intersection of the arms the position of the cylinder, and the arms two quarter moorings, laid at an angle of 120° with each other and with the up-stream mooring. Chain tackles were interposed between the moorings and the sling chain, and the hauling part was brought on deck, so that by heaving on one tackle and paying out the other two, or by heaving on two of the tackles, and paying out the third, the bottom of the cylinder could be moved in any direction. This plan of mooring was very efficient, and afforded complete control over the cylinders. When the moorings had been connected, the cylinder was lowered until about one foot of the third ring was out of the water. In this position the cylinder was partially afloat and partially suspended by auxiliary chains hooked on to the bottom, while the fourth ring was bolted on. The cylinder was then lowered three feet more until it was quite afloat, the cylinder mooring chains were hauled tight, and the auxiliary hook chains were cast off. The fifth ring was next bolted on, and the internal cylinder of brickwork was carried up flush with the fifteen-inch diaphragm. As the weight of the brickwork depressed the cylinder, the remaining wrought-iron rings and the cast-iron conical piece were bolted on, care being taken to adjust the position of the cylinder, by means of the moorings, as it went down. When the cylinder reached the bottom of the river, it was filled with water by means of a syphon, and the temporary bottom was driven out.

The system adopted for sinking the cylinders was by excavating the earth from the inside by means of a kind of rotary plough, or, as it was called, a boring-head, consisting of a horizontal disc-plate, with four blades at right angles to each other projecting vertically beneath the under side of the disc-plate. These blades were triangular in shape, and were armed with cutters, or ploughs, so that, in revolving, the boring-head excavated a conical hole nine feet in diameter. The boring-head was bolted to the bottom of a vertical shaft, consisting of two pipes concentric to each other, the inner one being thirteen inches and the outer one twenty-six inches in diameter. The space between the two pipes was made air-tight, the object being to combine great strength to sustain torsion with buoyancy in water. The boring-head was worked by a small compressed air-engine, assisted by hand-gear driving a pinion gearing into a large spur wheel bolted on to the top of the boring-shaft. The weight available for forcing the cutters into the earth was the constant weight of the boring-head, guide-frames, &c.; in addition to which, for cutting hard clay, it was sometimes necessary to fill one or two lengths of the air-tight space between the pipes with water. The earth, as it was cut, was removed up the hollow pipe of the boring-shaft by means of a current of water constantly flowing through it. For this purpose a syphon pipe was provided, the inner leg of which was immersed in the boring-shaft and the outer leg in the water of the river. The requisite current up the hollow shaft was obtained by pumping water into the cylinder, so as to raise its level above the level of the

river; then, by connecting the suction of the air-pumps with the syphon, the air was exhausted from it, and being replaced by water, a flow of water from the cylinder into the river was immediately established proportionate to the quantity thrown into the cylinder. The ordinary speed of the boring-head was one revolution in about a minute and a half or two minutes, and the average amount of boring done was about one foot in an hour. It usually took one day to sink the cylinder nine feet, and another day to remove and refix the gear, bolt on the additional segments, &c., so that the average daily advance was four and a half feet; but this rate of progress was increased when the operations were reduced to a regular system. One of the principal advantages of this plan of cylinder sinking was that the rate (and the expense also) of excavation did not increase with the depth, as the quantity of stuff excavated depended upon the power applied to drive the plough, and upon the volume of water flowing up the pipe. With regard to the land cylinders, which had to be sunk through 120 feet of earth, they were pitched in the dry season, and were sunk forty feet by open excavation, when the pumps were unable to contend with the water. The sinking was continued by boring, on the same principle as was adopted in the case of the river cylinders, with some modifications which simplified the process. Thus a turbine was substituted for the compressed air-engine, so that the operations both of driving the boring-gear and of removing the earth excavated were performed by the agency of water only.

An account was then given of an accident which occurred during a cyclone on the 9th and 10th of June, 1869, when two of the cylinders were undermined by scour and were overthrown. The measures taken to recover the cylinders were described in detail, but only one was raised, as the other became completely imbedded in the sand and was lost.

While the cylinders for the piers were being sunk, the main girders for the superstructure had been erected, and riveted up complete in two parellel rows on the embankment forming the east approach to the bridge, and the arrangements for the launching of the main girders were next proceeded with. For raising and transporting the girders on land two powerful lorries were provided, and by means of gearing the girders could be lifted by and suspended to the lorries, or, a girder being packed up, the lorries could be lifted on the girder as a fulcrum. The lorries were furnished with small flanged wheels, which were useful for moving them quickly when they had their own weight only to carry; but when loaded with the main girders they were always worked upon bar-iron rollers. The girders were built upon camber blocks, or wedges, and were supported by props on each side. One lorrie was attached to the east or after end of a main girder, and the other to a point about forty feet from the forward or west end. The girder was first raised from the camber blocks to a sufficient height to allow the bar-iron rollers to be passed beneath it; the girder being then packed up to this level, the lorries were lifted and the rollers were inserted. The lorries were next lowered on to the rollers, the girder was lifted until it was suspended between the two lorries, quite clear of all support, and then the after lorrie carried thirty-five tons, and the forward one seventy-five tons. One hundred Coolies hauling on a four-inch rope tackle sufficed to move the girder forward. The space between the piers No. 7 and No. 8 being mostly dry ground, a temporary staging was built to carry the girders across this opening. On the first of September, 1870, by means of the appliances which were described, the first girder for this (No. 7) span was launched forward until the west end was over the cross-girders of No. 7 pier, and the east end over No. 8 pier. The rollers having been then removed from beneath it, the girder was lowered on to sliding rails, the upper surfaces of which were level with the cast-iron bearing blocks prepared to receive the sole plates of the girder, and upon which rails the girder was pushed sideways to its final position. The second girder of No. 7 span was launched in the same way, and then the flooring girders were fixed in place. The main girders of the six remaining spans had to be launched over water where no staging could be erected. In this case the principle adopted was to float the forward end of the girders upon a pontoon, and to carry the after end on one of the lorries. Provision had to be made for constant variation of the water level, the minimum height from the water to the bottom of the girder to be floated being twenty-two feet and the maximum height forty-five feet. It was also necessary to warp the pontoon across a strong stream in a straight line, and to guard against the effect of the wind on the area of the girder, 2400 superficial feet. Means had likewise to be provided for lowering the forward end of the girder on to the pier after it had been floated across; and with respect to the after end of the girder, the road had to be extended fifteen feet beyond the centre of the pier, to carry the forward part of the lorrie on which that end of the girder rested. The period at which the girders were launched was the season of the falling of the water in the river, the subsidence of the water level being at the rate of six inches or eight inches per diem. To meet this condition shears were so devised as to admit of being lengthened in proportion to the lowering of the water level. The shears supported the girder at a point about twenty feet from the end, thus leaving about seven and a half feet overhanging the side of the pontoon for landing on the pier. To keep the pontoon as nearly as possible at right angles with the girder during the process of floating it across from pier to pier, two parallel lines were employed to pay out with, one being fast to each cylinder, and both lines being payed out simultaneously from a single bollard. Similarly, two parallel hauling lines, both wound on the barrel of the same winch, were used. Further to facilitate the object in view, two barges were moored in the line of the centre of the span, one at a distance of forty fathoms above the bridge, and the other at a corresponding distance below the bridge. Seven-inch warps, made fast to these barges, were led to capstans on the bow and stern of the pontoon. Auxiliary warps were also laid between the barges and pontoons, adjusted by luff-tackles, for use in case of any sudden alteration in the direction or strength of the wind. In conclusion, the programme was given of the several operations, thirty-four in number, necessary for launching a girder.

ZOOLOGICAL SOCIETY OF LONDON.

6TH February, 1872. R. Hudson, Esq., F.R.S., V.P., in the chair.—A communication was read from Dr. J. S. Bowerbank, F.R.S., containing the first portion of a series of papers, entitled "Contributions to a General History of the Spongiadæ," in which descriptions were given of several species of *Tethea*, and of *Halispongia choanoides*. A communication was read from Dr. John Anderson, F.Z.S., containing notes on a young living female of *Rhinoceros sumatrensis*, which had been captured in Chittagong, in February, 1868, and had been removed to Calcutta on its way to England. These notes were accompanied by a photograph of the animal from life. A second communication from Dr. Anderson contained notes on *Manouria* and *Scapia*, two supposed genera of Land-Tortoises, which Dr. Anderson showed to be identical with *Testudo emys* of Schlegel and Müller. Mr. Sclater read a paper on Kaup's Cassowary (*Casuarius Kaupi*), of which the Society's collection contained a living specimen. To this was added a list of the other known species of the genus *Casuarius*, and an account of their geographical distribution. A communication was read from Dr. A. Günther, F.R.S., on two species of Lizards of the genus *Hydrosaurus* from the Philippine Islands, for one of which, being hitherto undescribed, Dr. Günther proposed the name *Hydrosaurus nuchalis*. A second communication from Dr. A. Günther contained the description of a new genus and species of Characinoid Fishes from Demerara, proposed to be called *Nannostomus beckfordi*. A communication was read from Lieut. Reginald Beavan, of the Revenue Survey Department of India, containing descriptions of two new species of Cyprinoid Fishes from the Punjab. Mr. Howard Saunders, F.Z.S., exhibited specimens of and described a new species of Green Woodpecker, from Southern Spain, which he proposed to call *Gecinus sharpii*.

CO-OPERATION IN LONDON.

THE co-operative system at the present moment is attracting much of the public attention, and we may add that amongst the shop-keeping classes it is exciting a good deal of that indignation ordinarily felt by men who consider their interests injuriously attacked. It must be admitted that the Civil Service Stores, by selling at a mere fraction above prime cost, do go into a very dangerous competition with the ordinary West End trader. And if our civil servants do, as it is alleged, employ the time paid for by the nation in carrying on this dangerous competition, there is, we think, good ground for complaint. We are happy to see, however, that the co-operative system as it exists in the north of England, and which does not wage a ruinous competitive war with the regular trader, has been introduced to the general public of London by the "Alliance Co-operative Association," which, on the north of England plan, divides its profits amongst its customers in proportion to the amount of their purchases. This system has answered admirably wherever introduced, and has been of great advantage to those who have adopted it, particularly the working people. It secures purity in the articles dealt in, honesty in weight and measure, and all else essential for the purpose of securing perfect honesty in every transaction between the seller and buyer. Did the co-operative system do no more than this, we should have much to be grateful for, but when we know that in addition it abolishes the evil habit of credit, so common in trade, we have further reason to be thankful for the providence thus promoted. We, therefore, desire that this new experiment should meet with the encouragement it merits.

ATTERBURY'S IMPROVEMENTS IN PERMANENT-WAY FOR RAILWAYS.

WE again call the attention of railway contractors and others to this system of lines for railways, whereby cheapness and durability are, it appears, combined, as regards material and labour; so that a line once laid down in accordance with this invention would retain its durability for an indefinite length of time. The sleepers may be of wood of any kind, the line itself being constructed upon a peculiar principle; no iron rails, bolts, or chains, as at present used, being required. In case of accident to the carriages, it is affirmed that the line would not be disturbed or torn up. Under the present system of railway lines, the rails are so often getting out of order that it may be considered that about every five years an entirely new line is laid down by the repeated mending of the old one. Mr. Atterbury also claims to be able to take a new locomotive line on the sea, whether the water be shallow or deep, and to erect stations and branch lines. A line laid down would facilitate locomotion to all parts of the globe.

(Continued from page 34.)

Haughton Dale Works, Denton, near Manchester, Wire Card Manufacturer. Coating or preparing the surface of cylinders or rollers used in carding cotton and other fibrous substances.—177. A. S. Ayre, of High Street, Kingston-upon-Hull. Apparatus to facilitate the weighing of corn and other grain.—178. D. A. Doudney, Bedminster Somerset, Clerk in Holy Orders, and H. O. Adams, Birmingham, Warwick, Merchant. A self-acting disinfectant or perfuming apparatus for the handles of walking-sticks, whips, umbrellas, parasols, and other like articles generally used or carried in the hands.—179. E. T. Hughes, firm of Hughes and Son, Chancery Lane, London. Mechanical clutch to be used for converting rotary to reciprocating motion for friction brakes and for other purposes (com.)—180. E. T. Hughes, firm of Hughes and Son, Chancery Lane, London Locks for firearms (com.)—181. W. W. Hanscom, San Francisco, California, U.S., Mechanical Engineer. Applying power to the wheels of traction engines, portable engines, excavators, and other self-moving machines. (Complete Specification.)—182. A. Smith, of Batman's Hill, Bilston, Stafford, Farmer, but by trade an Ironworker. Apparatus for puddling iron.—183. J. Mitchell, Dyson, Street, Bradford, York, Contractor. Furnace bars and bearers.—184. W. H. Andrew, Sheffield, York. Securing and ornamenting the handles of table cutlery and other articles.

On 20th Jan.—185. W. Bracewell, Waterside, Colne, Lancaster, Blacksmith, E. Riley, same place, Publican, and J. Bracewell, Marsden, near Colne, Blacksmith. Machinery for distributing manure.—186. R. S. Wright, of the Inner Temple, London, Barrister-at-Law. Setting hydraulic rams—187. S. R. Smyth, C.E., Ethelburga House, London. A new self acting machine or apparatus for working sewing or other similar machines that are worked by foot-treadles, or by hand, or by other power—188. J. Booth, Nottingham Manufacture of fabrics in twist lace machines, 189. A. Warner, of Lee, Kent. Manufacture of iron and steel, and in apparatus employed therein.—190. P. Gaskell, Birmingham, Warwick. Apparatus for drawing off liquids.—191. E. T. Hughes, firm of Hughes and Son, London. Preparation of wool, either pure or mixed, with other fibrous materials intended to be spun into threads or yarns to be used for weaving (com.)—192. A. S. Macdiarmid, Liverpool, Lancaster, Wool Merchant Machines for cleaning wool skins—193. S. Lloyd, Sparkbrook, Warwick, Iron Tube Manufacturer. Apparatus for lighting fires and promoting combustion in fires.—194 T. K. Scraton, Birmingham, Warwick, Tailor and Outfitter. Manufacture of neckties or cravats.—195. W. Hulse, Birmingham, Warwick, Metallic Bedstead Manufacturer. Metallic bedsteads, cots, couches, and chairs, and in machinery or apparatus to be employed in the manufacture of the said articles, parts of which improvements are also applicable to the manufacture of metallic railing for other purposes.

On 22nd Jan.—196. G. Walker, of Newtownards, Down, Ireland, Flax Spinner and Manufacturer. Manufacture of coarse textile fabrics—197. T. Billington, Bamber Bridge, Lancaster, Spinning Master. Mules for spinning.—198 R. B. Arnau, Madrid, Spain, at present residing at Torrington Square, Midd. Apparatus for registering the quantities of liquids withdrawn from casks or other receptacles.—199. D. Joy, Middlesbrough, York, Engineer. Means and apparatus for the removal of slag from blast furnaces.—200. W. R. Lake, firm of Haseltine, Lake, and Co. Furnaces and apparatus connected therewith, more especially designed for an improved method of heating gas retorts (com.)—201. H. B. Fox, Oxton, Chester. Filtering jug.—202. A. Higginson, Liverpool, Lancaster, Marine Draughtsman. Motive-power engines, engine governors, and pumps.—203. R. Stone, Liverpool, Lancaster, Casting or moulding applicable to ceilings, internal and external walls, roads, navigable vessels, and other large surface structures.—204. T. J. Smith, firm of Robertson, Brooman, and Company, Fleet Street, London. Knitting frames or machines, with appliances for diminishing or fashioning articles made thereon (com.) (Complete Specification).

On 23rd Jan.—205. E. Leigh, Manchester, Lancaster, M.E. Construction and propelling of [illegible] railway [illegible] and other purposes.—206. H. Hughes, Homerton, Midd., Engineer. [illegible] and neckties.—207. B. B. Hotchkiss, New York, U.S. Wood pavements, and in machinery for laying the same—208. V. Count di Targulina, Bernard St., Russell Sq., Midd. Construction of bits for horses and animals.—209. J. D. Asquith, Morley, Leeds, York. Machinery for fulling, or milling and washing woollen and other woven or felted fabrics.—210. W. Bradburn, firm of Bradburn and Co., Wednesfield, near Wolverhampton, Stafford, Manufacturing Chemists. Application of the gases and vapours or fumes resulting from the burning of pyrites, cinders, and of the acid liquid produced by the absorption thereof.—211. A. Wood, Edinburgh, Midlothian, N.B. Cleaning tramways, and in apparatus employed therefor.—212. R. J. Wood, Edinburgh, Midlothian. Sweeping streets or roads, and in the machinery or apparatus employed therefor.—213. A. Wood, Edinburgh, Midlothian, N.B. Tramway cars.—214. F. W. Salmon, Bishopton, Stratford-on-Avon, Warwick. Incubators.—215. J. Whittingham, Cross, Willaston, Nantwich, Chester, Surveyor. Road-rolling engines, whereby they are made suitable also for other purposes—216. A. V. Newton, Chancery Lane, Midd., Mechanical Draughtsman. A self-acting device for regulating the tension on the warps of ribbon and other looms (com.)—217. A. Thomas, Cinderford, Gloucester, Engineer. Improved drying apparatus.—218. W. R. Lake, firm of Haseltine, Lake, and Co., Southampton Buildings, London. Hoists or elevators (com.)—219. W. R Lake, firm of Haseltine, Lake, and Co., Southampton Buildings, London. Mechanism for changing shuttle-boxes in looms for weaving (com.)—220. A. M. Clark, Chancery Lane, Midd. Railway carriage-axles and wheels (com.)—221. V. de Tivoli, Brixton, Surrey. Manufacture of brushes, brush rollers or cylinders, and brooms, and in machinery for the same (com.)

On 24th Jan.—222. T. C. Hinde, Fownhope, near Hereford, Colliery Proprietor. Manufacture of iron and steel.—223. A. Ford, Elgin Crescent, Notting Hill, Midd., Gentleman. Mode of treating linseed and other seed and vegetable oils, so as the better to fit them for employment in the arts and manufactures—224. N. Lloyd, Manchester, Lancaster. Fixing colouring matters on prepared fabrics or yarns.—225. T Floyd, Adam Street, Adelphi, Midd. Coverings for the head, whereby a refrigerating or cooling effect is produced. 226. H Bortueux, Antwerp, Belgium Compound high and low pressure steam-engines.—227 J. S. Russell, Sydenham, Kent Ordnance and projectiles, and cartridges for the same.—228. H. A. Dufrené, Paris, France, C.E Production of cold (com.)—229 M H. Hollingworth, Girlington, near Bradford, York Boots and shoes, and other coverings or protectors for the feet.—230. T. Hannay, Glasgow, Lanark, N B, Ironmaster. Reversing mills for rolling iron.—231. J. S. Crapper, Hanley, Stafford, Manufacturing Dentist. Apparatus for economising and administering nitrous oxide or other gases for dental or surgical purposes.—232. H. Jones, Nottingham, Auctioneer. Moustache protector and trainer.—233 F A. Gatty, Accrington, Lancaster, Manufacturing Chemist. Ventilating sewers, drains, cesspools, and soil pipes—234. J. Mellady, Denton, Manchester, Manufacture of felt hats.—235 A Budenberg, firm of Schuffer and Budenberg, Manchester, Lancaster. Sugar refining and, in the centrifugal machines employed therein (com.)—236. W. S. Hutton, Leeds, York, Engineer. Arrangement and construction of forge hammers, stamps, and other similar machines worked by steam or other motive power for crushing ores and other purposes, and in utilising the power resulting from the action of such machines—237. H A. Bonneville, Piccadilly, Midd. Bellows for forges or any other works (com.)—238. H. A. Bonneville, Piccadilly, Midd. Copying presses (com.)—239. J. Parry, Manchester, Lancaster. Furniture castors.—240. W. Taylor, Woolwich, Kent, Naval Architect. Method or means of indexing or registering the condition or state of iron or metal ships, vessels, or other floating bodies, as well as of marine and land boilers, reservoirs, tanks, [illegible], and other articles of metal.—241. G. J. Gameson, Upper Norwood, Surrey. Pump pistons.—242. H. J. Hill, Pimlico, Midd. Self-acting boat-detaching apparatus.

On 25th Jan.—243. H. C. Bowé, Quebec, Canada. Mode of making cast steel at one operation of a homogeneous character and of any desired quality (com.)—244. A. Millar, Mechanician, High Holborn, London. Counting apparatus.—245. H. A. Bonneville, Piccadilly, Midd. Manufacturing gas for lighting and heating (com.)—246. W. D. Bogue, Chancery Lane, Midd., Barrister-at-Law. Pipes for smoking tobacco—247. R. J. Ellis and G. Dobson, Liverpool, Lancaster. Composition for preventing incrustation and corrosion in steam boilers and other apparatus for generating steam—248. H. Aylesbury, Gloucester, Mineral Water Manufacturer. Stoppers for bottles—249. G. Abraham, Taunton, Somerset Ironmonger. Fittings of window-sashes.—250. D. A. A. Nobbe, Kenilworth Road, Roman Road, Old Ford, Midd. Fire-escapes.—251. W. R. Lake, firm of Haseltine, Lake, and Co, London. Lubricating apparatus (com.) (Complete Specification).—252. B. J. B. Mills, firm of Harris and Mills, Southampton Buildings, Midd. Seal locks (com.)—253. D. A. Burr, Washington, U.S. Diaphragm motor, and its application in automatically operating valves and levers in low-water detectors, air-compressing machines, supply or discharge pipes, double-acting vacuum pumps, and other hydraulic or pneumatic machines and engines, by means of an intermittent fluid pressure (com.)—254. A Friedmann, Vienna, Austria, Engineer. Producing a self-acting circulation in tubular steam boilers employed for locomotive engines, and of collecting the precipitates of the water of boilers generally.—255. A M. Clark, Chancery Lane, Midd. Electro-magnets applicable for use in electric and electro-telegraphic apparatus (com.)—256. R. D. Clark, Master Mariner, and R. Jobson, Blacksmith, both of West Hartlepool, Durham. Detector for ascertaining errors in ships' compasses.

On 26th Jan.—257. A. Ungerer. Process or method and apparatus for preparing plants to render them useful in the manufacture of paper pulp.—258. J. L. Tomkys. Lamps for burning hydrocarbon spirit or oils.—259. W. Walton. Manufacture of wire cards.—260. C. J. Eveniche Construction of portmanteaus, travelling-cases, or boxes for containing clothes and other necessary articles used by travellers.

261 J Boyd and W. Henderson. Machinery for weaving hair cloth—262 G. Weir and J. Weir. Steam boilers.—263. A. M. Clark. Breech-loading firearms (com.)—264. W. R. Lake. Machinery for nailing or pegging the soles of boots and shoes to their vamps or uppers (com.) (Complete Specification.)

On 27th Jan.—265 J. Middleton. Adjusting or correcting ships' compasses used in iron, composite, wood, or any other sailing or steam vessels in any part of the world by observation of the celestial bodies as well as terrestial objects—266. A. V. Newton. Kilns for burning bricks, tiles, and pottery, and in the mode of utilising the heat generated therein (com.)—267. J. Woodward and J. Emms. Breech-loading firearms—268. D. O. Macomber. Manufacture of Ordnance—269. D. T. Bostel. Dry earth closets and urinals.—270. A. Annandale. Manufacture of paper, and in machinery or appliances for the purpose.

On 29th Jan.—271. N. Ennor. Machinery or apparatus for crushing, stamping, or pulverising ores and other substances, parts of which improvements are applicable for lifting, winding, and other purposes.—272. W. G. Walker. Preserving food.—273. M. Myers. Manufacture of caps and other like coverings for the head.—274. W. E Newton, C. E. Method of and apparatus for transmitting motion or motive-power to variable distances (com.)—275. H H. Murdoch. Gas-lamp for illuminating the interiors of railway and other carriages, or places where, under ordinary circumstances, motion causes unsteadiness or flickering of the gas jet or flame (com.)—276. R. Glasspool. Alarum indicating and silent feed apparatus for flour and grist mills (com.)—277. J. E. T. Woods. Reverberatory and other furnaces.

On 30th Jan.—278. R. Saunders Anchors and their accessories.—279. W. R. Lake. Improved gypsum cement (com.)—280 G. H. Ellis. Horse-shoes—281. C. Quick and F. N. Normington. Carriages—282. J. Box, C.E. For preparing and condensing peat for fuel without moulding or pressing, and also for a new and improved oven for making peat charcoal.—283. H. W. Ripley. Colouring fabrics (com.)—284. S. Rowan. Joints or hinges, and in the machinery to be employed therein.—285. S. Last. Apparatus for cutting and planing wood and other like substances.—286. G. W. R. Pigott. Covered [illegible] and in the means of

... apparatus for effecting the same.—287. F. R. ... Machinery or apparatus for placing driving-bands on the pulleys or drums of shafting while the said pulleys or drums are in motion —288 P. W Seymour. Construction of portable magnets to be employed for minature and other purposes.

On 31st Jan —289 J. Ward. Securing carriages to 'ladies' ears —290. W. F Smith and A Coventry Planing machines.— 291. E. Barthelmes Shuttle sewing machines — 292. B Dobson, T H Rushton, and W. Dobson Machinery for ginning cotton.—293. R. Johnson Mode of and apparatus for drying and superheating steam —294. J. Knowles. Instrument for rooting up weeds.—295 G Piedbœuf. Apparatus for the manufacture of steam boilers.—296. J. Cooper Moulding boxes used in making moulds for casting metals — 297. J. Edwards Permanent way of railways —298. M. Wigzell Drawing board for the purpose of stretching drawing paper (or other materials for drawing, tracing, or painting upon) on one or both of its sides — 299 J Steele. Improved claw wrench for screwing gas-pipes and for other similar purposes —300 A. M. Clark. Cigarettes (com.) — 301. J Ames. Foot-warmers —302 C Wood Apparatus for cooling blast furnace or smelting furnace slag or scoria as it runs from the furnace, and loading the same into waggons or trucks in a solid state — 303 J A B Williams Stoves for drying artificial fuel and other substances —304 L Hault and E Chassan Telegraphic printing apparatus.—305 J A Jaques and J. Banks. Manufacture of surgical instruments. —306 J D Sprague Sweeping or cleaning roads, ways, pavements, paths, and floors or surfaces.—307 J Petrie, junior Machinery for washing or scouring and drying wool and other fibrous materials

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On 31st Jan.—308. A. V. Newton. Furnaces for the smelting of iron and other ores (com.)—309. C. E. Parker-Rhodes. Construction of military and other boots and shoes, or coverings for the feet and legs.—310. J. H. Johnson. Fluting or crimping machines (com.)—311. A. McDougall. Manufacture of common salt.—312. J. H. Johnson. Apparatus or means for correcting or compensating for the deviations of the mariner's compass (com.)—313. J. H. Johnson. Gold and silver from lead containing the same (com.)—314. W. A. Gibbs and A. Borwick. Apparatus and arrangements for drying.

On 1st Feb.—315. W. R. Lake. Shuttle-operating mechanism of looms for weaving (com.) (Complete Specification.)—316. W. R. Lake. Apparatus for detecting leakages in gas and water pipes and other like fittings or connections (com.)—317. W. Weldon. Manufacture of chlorine, and in apparatus and arrangements for that purpose.—318. G. Allibon and A. Manbré. Steam boilers or steam generators.—319. M. Bayly. Printing with or without self-inking apparatus, perforating, stamping, copying, and embossing combined in one machine.—320. W. Davis. Apparatus for taking votes at parliamentary and municipal elections.—321. W. R. Lake. Burner for lamps and other illuminating apparatus (com.)—322. E. Lloyd. Construction of sashes and frames for the protection of flowers, fruit, and other trees and plants.—323. W. Waplington and G. Barker. Manufacture of spiegeleisen.—324. J. L. Rosborough. Apparatus or means for transporting mud and sweepings collected from the surfaces of the streets and thoroughfares.—325. J. H. Johnson. Manufacture of iron and steel (com.)—326. G. Fletcher. Evaporating and granulating pans (partly a communication.)—327. W. J. Curtis. Means of and apparatus for obtaining extracts or infusions from vegetable or other substances, and filtering or clarifying liquids.—328. G. H. Carter. Mechanical arrangements for converting reciprocating motion into rotatory motion.—329. W. R. Lake. Method of preparing and preserving hops for the manufacture of beer and for medicinal purposes (com.) (Complete Specification.)

On 2nd Feb.—330. E. Gilyard. Furniture for locks.—331. W. Walker. Improvements in and machinery for the manufacture of "hard laid" and "soft laid" twine, "mill banding," strands for ropes and other purposes, and cordage generally, from hemp, flax, and other like fibrous material.—332. F. M. Franklin. Improvements in capsules.—333. C. F. Schiller and G. W. F. Wagner. Improved motive-power engines.—334. W. S. [illegible] and O. G. [illegible]. Taking the poll of voters, and for enumerating and registering votes, and in the method of and apparatus for recording and indicating the poll.—335. H. A. Vernon. Trail of field guns, dispensing with limbering and unlimbering.—336. G. Jowett. Apparatus for beating eggs.—337. G. J. Cross. Manufacture of iron for tramway wheels or tyres.—338. H. Jarman and G. Mitchell. Improvements in furnaces, heating of ovens and boilers, purifying heat, economising fuel, and consuming smoke.—339. J. H. Johnson. Nail machines (com.)—340. J. H. Johnson. Burning hydrocarbons, and in apparatus to be employed therefor (com.)—341. S. Grafton. Pocket match holders.—342. J. Thorpe. Manufacture of garden tallies or plant labels or markers.—343. E. Jones. Cartridge cases, and in the apparatus to be used in the said manufacture.—344. A. V. Newton. Mode of and apparatus for manufacturing terry and cut-pile carpets and other terry fabrics (com.)—345. W. R. Lake. Improved wood pavement (com.)—346. W. R. Lake. Packing and securing blocks laid for paving and for other like purposes (com.)

On 3rd Feb.—347. R. Punshon. Apparatus for measuring and registering liquids.—348. S. Cutler. Fastening and securing window-sashes, and preventing the rattling thereof.—349. J. L. Clarke. Method of and apparatus for preventing candles from guttering.—350. J. C. Calvert and J. Taylor. Apparatus for heating water, steam, or other fluid.—351. W. Todd and D. Winn. Machinery for pressing, smoothing, and finishing woollen cloth or other fabrics.—352. P. McDonald. Self inking letter, bill, and card-stamping machines and endorsing apparatus.—353. W. Blundell. Improved compound cape, applicable also for use as a bed and for other purposes.—354. W. Betts. Capsules.—355. W. Betts. Machinery or apparatus for capsuling bottles and other like receptacles.—356. A. L. Dennison. Watches and pocket chronometers.—357. J. L. Norton. Stables, sheds for cattle, and slaughter-houses, and in paving or flooring for the same and other surfaces.—358. E. Burgess. Apparatus for evaporating and incinerating alkaline lyes or solutions ordinarily used in the manufacture of paper, and in the treatment of such solutions, when spent, for the purpose of recovering therefrom valuable chemical products.

On 5th Feb.—359. W. Weldon. Obtaining and decomposing sulphate of sodium and sulphate of potassium, and in obtaining hydrochloric acid and chlorine.—360. W. Vale. Watch-keys.—361. J. G. Cunningham and J. Corbin. Improved agent to be used in the preparation or production of baths.—362. A. G. Bell, Doctor of Medicine. Improved galvanic belt.—363. R. Brough. Steam-engine governors, and speed regulators for machinery.—364. A. Oldroyd. Manufacture of india-rubber and other tobacco pouches and purses.—365. E. Field and F. M. Cotton. Steam-engines.—366. A. V. Newton. Manufacture of pocket and other diaries (com.)—367. G. H. Hussey. Asphalte pavement.—368. [illegible] Boyd. Manufacture of gold and silver [illegible]

* "(com.)" means "[illegible] communication," [illegible] abroad.

and medals.—369. E. Pace. Machinery or apparatus for cutting splints —370. G. Rydill. Machinery and apparatus for dyeing or staining animal and vegetable substances; also suitable for drying the same, and for bleaching purposes.—371. S. W. Wilkinson. Machinery and apparatus for winding and balling yarn. —372. S. F. Hulme and G. Hulme. Covering for floors with designs or patterns of great durability. -373. W. R. Lake. Manufacture of sheet-iron (com.)—374. J. Edwards. Locks. —375. H. A. Bonneville. Apparatus for lighting gas by electric currents or otherwise (com.)—376. H. A. Bonneville. Alimentary drink (com.)—377. G. W. Lamb. Boots and shoes, and machinery or apparatus to be used therein.—378. H. Holland. Clippers for clipping or shearing horses and other animals.

On 6th Feb. — 379. F. G. Prange and W. Whittbread. Utilisation of sewage.— 380. S. Mendel. Mode of and apparatus for applying colour to blocks for stamping trade-marks on woven fabrics.— 381. W. W. Hulse and B. T. McKay. Manufacture of floor-cloth. —382. R. Birdsall. Ornamenting book covers and similar articles, also applicable to the ornamentation of leather, vellum, cloth, and other like surfaces.—383. J. Bell. Shedding motion for looms for weaving fancy fabrics.—384. J. Phillips. Ship's signal lamps.—385. W. S. Sutherland. Uniting plates, tubes, and other forms of iron or steel, and in means or apparatus employed therein. - 386. R. Titley. Louvres and louvre blinds, and in fittings or mechanism for actuating, adjusting, and fixing louvres and louvre blinds for various purposes. —387. W. R. Lake. Engines to be operated by gunpowder or other explosive material (com.) (Complete Specification.)— 388. A. M. Clark. Sewage and other ammoniacal liquors, and in the manufacture of certain salts for this purpose (com.)

On 7th Feb. —389. A. Baumann. Steam-engines. (Complete Specification.) - 390. R. Timbrill. Making gloves and mittens without seams in the palm of the hand or around the base of the thumb, and with less seams in the fingers of the said gloves than in ordinary gloves (com.)—391. C. E. Billing. Apparatus for heating by the flame of gas.— 392. F. E. B. Beaumont and C. J. Appleby. Rock or stone drilling, tunneling, and boring apparatus (Complete Specification.) — 393. J. Sellars. Manufacture of size or other substances used for stiffening and weighing cloth, yarn, and paper. -394. F. Taylor. Construction of bedsteads for invalids.—395. G. Smith. Instrument for clipping hair or wool from horses or other animals.—396. C. Henman. Constructing hot or tepid and cold sea, river, or spring water plunge or swimming baths, for use on land or water. —397. J. Harris and D. Normington. Joints of metallic bedsteads, sofas, couches, and other articles of like manufacture. —398. E. Morrall. Machinery employed in the manufacture of sewing-machine needles.— 399. A. M. Clark. Sewing leather and other thick or tough material, and in machinery and thread for the same (com.)—400. E. Jones. Military spade shovel.—401. N. P. Stockwell. Sewing machines (com.)—402. J. M. Napier. Weighing machines.— 403. W. Willoughby, J. Willoughby, and S. Willoughby. Steam stamping machine for ores and other hard substances. -404. J. H. Johnson. Production of alcoholic and other fermented liquors (com.) —405. W. R. Lake. Combining earthy or mineral substances with vegetable substances (com.)—406. W. E. Newton. Weighing machines (com.)

On 8th Feb.—407. T. Gibb and C. Gelstharp. Furnaces for carbonating or drying alkaline salts and other substances, and in the method of working the same. — 408. T. Rowley. Lubricating spindles used in preparing, spinning, and doubling cotton and other fibrous materials. — 409. P. J. N. Gombert, C.E. Railway breaks.—410. T. Boar. Adaptation of mica (sometimes called talc) to apparatus for saving life from fire.—411. D. S. Brown. Aërial machine.—412. T. Cockshott. Method of laying submarine telegraph cables in connection with shipping in different rivers, harbours, and seas, and other places.—413. J. Young. Treatment of natural petroleums.—414. A. M. Clark. Manufacture of metallic knitted fabrics and chains, and in machinery for the same (com.) (Complete Specification.)

(Continued on page 53.)

The Scientific Review.

APRIL 1, 1872.

PRACTICAL SCIENCE AND POLITICS.

SCIENTIFIC men and inventors usually hold aloof from the political arena; they seem to look upon it as a lower world, in which there is nothing to be found but strife, jobbery, and loss of reputation; and we cannot say that their estimate of it is altogether wrong. Nevertheless, their policy in this matter is a mistaken one, if their labours are to be any good to the State, and the Franco-Prussian war, the *Megæra* catastrophe, and many other occurrences of the present time show us how much the real scientific man and the true inventor are needed amongst us. Such being the circumstances of our position, it is truly lamentable to find that the very men who could do most for the State are just those who refuse to lift a hand to help.

Anyone who knows anything of the laws and institutions of this country, knows very well indeed, that those who have political power, and can bring it to bear upon our parliamentary and governmental system, have a good chance of being heard with effect; whilst such persons as are not in this position are very likely to be heard with indifference or treated with total disregard.

A notable instance in illustration of this state of things is the present Patent Law inquiry now proceeding before a Select Committee of the House of Commons, which has been very careful to collect the evidence of eminent Queen's counsel, large manufacturers, and wealthy traders, but has scarcely deigned to hear one accredited representative of the inventive and artisan classes. Another case is that of certain proceeding of our Government of no remote date, whereby the use of a navy ship was denied to our men of science for the conveyance of themselves and their necessary scientific appliances to Spain and Sicily, to view a total eclipse of the sun, at the same time that the American Government had fitted out an expedition of their own for the purpose, and did not hesitate to offer to do for our men of science what our own Government refused to do for them—facts showing that our Government is one wholly wanting in any proper respect for science, and takes a low estimate of the value of the good wishes of the scientists. Indeed, there is now before the public the case of the *Ariadne* disaster, where, as our contemporary the *Daily Telegraph* points out, scientific authority and the adoption of suitable inventions might have saved the loss and scandal attending that accident, by which ten lives have been miserably lost from that frigate. Perhaps (adds that journal) the next melancholy story which we shall receive from the sea will be of some transport or merchantman whose crew, driven from their course or forced to take to the boats, has all but perished for want of drinking-water. Here we have a peril which ought by this time to be almost exorcised from the list of dangers of the deep. When the poet wrote "Water, water everywhere, yet never a drop to drink," science promptly pointed out that fresh water of most excellent character may be obtained from the ocean if there be only fuel, fire, and some such machine at hand as Dr. Normandy's distilling apparatus. Vessels under steam have now, indeed, for the most part, a condensing arrangement as part of their machinery, and much of the water for ablutionary purposes is constantly obtained in this way on board men-of-war and passenger ships. But why should not all sea-going craft carry one of these simple contrivances? Tanks may leak, voyages be prolonged, water may turn bad, boats may need to be suddenly provided, and if a ship has only such a machine she can manufacture four thousand gallons of good water with a single ton of fuel. In the apparatus mentioned, the oxygen and carbonic acid contained in the brine are ingeniously employed to aerate and refrigerate the condensed fresh water. Again there are the ship-mattresses of Admiral Ryder, stuffed with granulated cork, much cheaper than the horsehair now served out, and each capable of keeping three men afloat. The Russian navy uses them, and recently a frigate's whole company was saved by their perfect buoyancy after a terrible collision. Pitched overboard from the hammock-rails, these articles would be the salvation of many a boat's crew; and in future naval engagements, when, what with ramming and heavy guns, vessels are so likely to go down "all standing," how great is the saving of life which might thus be effected! But it seems to be nobody's business to keep an eye on these and similar inventions. We jog on in the old way, finding out the forgotten points of safety by cruel accidents, against which science long ago has offered us ample precautionary devices.

We have also, as a result of this policy of abstention, technical education now hanging fire, because there is no one sufficiently well understanding the subject who has any considerable political status, and is ready to work in its behalf. Anyone so situated would find no difficulty in getting a sound national measure speedily brought into active operation, for the subject is acknowledged to be one of importance, requiring only the man of sufficient political position to promote it in order to its becoming an accomplished fact, as our friends across the Channel would say.

Last, though not least, we have the question of the status of men of science, technicists, and inventors respectively. As regards the second of these classes, a good scheme of technical education ought to provide for them, whilst a good Patent Law would probably satisfy the aspirations of the last. We have lately had baronetcies and knighthoods showered down upon mayors and civic magnates, and ever and anon we have some official meddler and muddler rewarded with these dignities or turned into a C.B. It is seldom we find men so deserving of public dignity as Sir Antonio Brady distinguished in this manner, or we should have little to object to on this score. We do not much care for the ordinary title of knight, because it has thus become a badge of mere blown-out bumbledom and peacockdom; but if our ancient Order of the Bath could find room for a section for merit, and this could be reserved for the classes of persons we have named, with subventions provided for those who deserved and needed them, something would be done which it would be worth while seeking to accomplish.

We do not ask anyone to become political partisans of the old school—that school so rapidly passing away; and if any of the present political parties would live in the future they must transform themselves into a national party for promoting the common good of the whole people, regarding all workers as the most considerable constituent part, and making the advance of civilisation its principal object. In such a spirit as this, and in no other, do we invite the men of science and invention to take part in politics.

Reviews.

A Memoir of John Elder, Engineer and Shipbuilder. By W. J. Macquorn Rankine. William Blackwood and Sons, Edinburgh and London. (First Notice.)

This is a biographical work of great interest, as all our readers will probably anticipate when they note that its author is the eminent professor whose name appears on its title-page. To the world of practical science the life of such a man as Mr. Elder cannot fail to be a matter of deep interest, for men who can plan and execute great works, involving the practical application of scientific principles, although, fortunately for this country, no rarities amongst us, are by no means too numerous, and on such men depends the valuable realisation of the labours of scientists; in fact, by their means the researches of experimental philosophers become transmitted into additional aids of civilisation, gladdening our hearths and homes with new comforts and new joys, and giving employment to large numbers of our population. That Mr. Elder was one of the men we have referred to this memoir abundantly proves, as we hope to convince our readers by quotations from the work itself.

Rudimentary Treatise on Geology. (Partly based on Major-Gen. Portlock's Rudiments of Geology). Part II.—Historical Geology. By Ralph Tate, Assoc. Lin. Soc., F.G.S., Corr. Mem. Acad. Sciences, Philad., etc., with illustrations and index. London: Lockwood and Co., 7, Stationers' Hall Court, Ludgate Hill.

This is another addition to these popular treatises, and is fully equal to any of them.

The work is a complementary treatise to the volume on "Physical Geology" by Mr. Tate, which we recently noticed. It is an epitome of the "History of the British Stratified Rocks." The facts and statements are carefully selected, and recent observations of importance are duly noticed. Discussion of any subject is avoided, and no deductions are made which are not in accord with the opinions generally accepted.

A full index is given, and all the fossils of which there are woodcut figures in the text are printed in italics in the index.

The following is a good example of the contents of the work:—

"The earliest flora with which we are acquainted is that of the Cambrian. It consists of marine aquatic plants, *Algæ*. The first trace of a land-plant is at the very top of the Upper Silurian, and we may conclude that there were no terrestial plants during the long Silurian epoch—a vast interval, far exceeding in duration that of any other system. In the Devonian system, in addition to *Thallogens* and *Acrogens*, are found in Nova Scotia the first traces of *Gymnogens*, but remains of vegetable life are scanty, though affording undoubted evidence of the existence of the three classes. In the Carboniferous system the *Acrogens* (ferns, as *Pecopteris*, and *Calamites*, *Sigillaria*, *Lepidodendrons*, &c.) and *Gymnogens* (*Peuce*, *Pinites*, &c.) unite to form its magnificent flora. Palms and other Endogens are comparatively rare, being noticed for the first time. In the Permian a similar flora prevailed, though very much reduced in quantity. This system closes the Paleozoic period, during which Acrogenous plants predominated.

"Ascending to the Mesozoic period, we find in the Trias of this country plants to be exceedingly rare; but throughout the whole period Gymnogens are the prevailing forms. *Conifers* and *Cycadaceæ* are abundant, and give a peculiar character to the vegetation. The flora of the Oolite differs from that of the Carboniferous system chiefly in the predominance of Gymnogens over Acrogens, some of which appear to be generically identical with some now living. The cone of *Araucaria sphærocarpa* of the Inferior Oolite is hardly distinguishable from that of an existing species; and several species of *Pinus* appear in the Lias, Purbeck, and Neocomian. In the Cretaceous rocks plants are not common, but Coniferæ are frequent in the Neocomian and Wealden. In the Chalk of the Continent there are a *Juglans* and several other species of true Exogens; but nothing of that type has been observed in this country.

"In the Cainozoic period we find evidences of a very different vegetation, Exogens being decidedly the most abundant. Endogens, especially Palms, are numerous, but Acrogens are comparatively rare. The flora of the Eocene and Miocene periods approximates nearer to that of recent times, yet differing much from our present European vegetation, and has great affinity with that of New Holland and Australia.

"(2.) *Fossil Zoology.*—In the tabular arrangement of the classes and orders of the animal kingdom the names of the extinct ordinal types are printed in italics. These are seventeen in number—five being found among the Reptilia, one in the Birds, one in the Amphibia, two among the Crustacea, three in the Brachiopoda, three in the Echinodermata, and two among the Actinozoa."

Pauperism and Crime: A True Cause and a True Antidote. Dedicated to her Royal Highness the Princess of Wales. By Robert Hill, 32, Nelson Square, Blackfriars Road. London: Kelly and Co. 1872.

The title of this little work is one we cannot approve of, for on perusal of its contents it turns out to be an elaborate piece of advocacy of a new scheme for utilising the Alexandra Palace and Park (one feature of which, namely, a twopenny admission day, is worthy of commendation); the only connection of this scheme with the subject of the title-page being enunciated in the following extract:—

"Have you ever seen and pitied, in piercing snow or soaking rain, in the streets of London, the untutored, uncared-for, wellnigh-starved little urchins known as 'gutter boys'—living no one knows how, except on the buoyancy of boyhood, and the loving self-sacrifice which will be found to prevail among this neglected brotherhood?

"Rescued from this miserable condition, a happy band of these poor boys are being fed and trained as the first corps of the Alexandra Brigade of—in the mornings cleaners and gardeners, and in the afternoons musical performers.

"Is this, and are many other such good works just in seed to be abandoned? or is the institution to be allowed (as properly established it will) to grow as a tree planted by the riverside, to bring up and instruct by thousands, and send forth as good men and true and useful citizens those who otherwise may fill our gaols and our poorhouses?"

Rational recreation for the people and the encouragement of gutter boys' movements are good things, but they will not be advantaged by pamphlets with delusive titles.

Insects at Home; being a Popular Account of British Insects, their Structure, Habits, and Transformations. By the Rev. J. G. Wood, M.A., F.L.S., &c., author of "Homes Without Hands," "Bible Animals," &c., with upwards of 700 figures by E. A. Smith and J. B. Zwicker. Engraved by J. G. Pearson. London: Longmans, Green, and Co. 1872.

This is a delightful and most instructive book, worthy of being made a drawing-room table-book, affording to the student the means of acquiring sound information, and to every lover of natural history pleasant leisure-hour reading. In it will be found a comprehensive account of the insects which inhabit England, together with the principal details of their structure, and the most interesting incidents of their mode of life.

Greater stress is laid on the habits of the insects than on their anatomy. As, however, a general knowledge of the various parts of an insect and of the terms applied to them is absolutely necessary for all who wish to study the subject, however superficially, together with the different groups of insects, those portions of their structures are given which serve to distinguish them from their fellows.

Prefixed to the descriptions of the chief groups are chart-drawings of their anatomy, enabling the reader to recognise the various portions of an insect when he examines it, so that no reader need be puzzled as to the difference between mandible, maxilla, labium, and mentum. For example, the chart-drawing on page nine fully exemplifies the structure of a beetle, and is in fact a key to that of all insects; that on page 296 gives all those points in which the bees, wasps, ants and their kin differ from the beetles; and that on page 385 performs the same service with regard to the moths and butterflies.

The author states that the reader may probably notice that these figures of insects are but slightly shaded, and in many cases are little but outline, and that this is intentional, the shading being omitted in order that the reader may supply its place by colour. In every case where red, yellow, or light hues of any tint are to be used, their place is left as nearly blank as possible; and as the insects are described fully in the text, there will be no difficulty in applying the colours. Amongst other recommendations, he advises the liberal use of ox-gall in mixing the colours, so as to neutralise the oily lines of the printer's ink.

Notes on Nuisances, Drains and Dwellings.—A short popular treatise on the form and origin of the various nuisances arising in houses from imperfect drains and other causes; with practical hints for their detection and cure. By W. H. Penning, F.G.S. Price sixpence. London: Baillière, Tindall, and Cox, 20, King William Street, Strand.

This little pamphlet should be studied by everybody. It is a complete *exposé* of the miscalled sanitary system under which we most of us now live; and from a prefatory note it appears that the author, in common with every other member of his family, has suffered severely from the nuisances he details. The notes therefore are founded upon real and painful experience. These nuisances he terms sewer-gas, gas, decaying organic matter, paper on walls, damp, smoke, and sundry nuisances.

The two subjects, nuisances and ventilation, are each treated of under three heads; namely, Nuisances: 1. Form and origin; 2. Detection; 3. Remedy. Ventilation: 1. Exclusion of foul air; 2. Expulsion of carbonic acid; 3. Importation of oxygen.

NUISANCES.

Sewer Gas.—Of all the nuisances to which we in our houses are subject that of sewer-gas is the most deadly, although not necessarily the most unpleasant. To our forefathers it was almost unknown, but in these days of main-drainage it is brought in a scientific manner, and delivered within the precincts of our dwellings. Let the town resident reflect that the drains from every house in his district discharge their contents into the same sewer, that all the sewers probably converge to one point—the lowest available—that all the gases, arising from the rapid decomposition of matter, within these sewers are pent up therein under considerable pressure—matter in its gaseous form filling a much larger space than when in a solid or liquid state. He will come to the conclusion that the gases must go somewhere, and that the more perfect the system of pipes and joints, the greater the chance of their bursting forth at every connection with those drains there may be in and about his dwelling.

This sewer-gas is at all times injurious to health, its inhalation producing languor, low fever, and ulcerated sore-throat, while, under certain conditions—impregnation with germs from an infected person—the dreadful disease

known as typhoid fever. It has a faint over-powering odour, almost imperceptible except to those possessing delicate sense of smell, but is at times intermingled with other exhalations which render its presence more easily detected if also more disagreeable.

But the sense of smell must not be the sole reliance for the detection of this nuisance, for, as is very properly observed, it may assist in, but of itself will scarcely suffice for, the discovery of this noxious exhalation. A feeling of oppression, of faintness, or of closeness in the air of a house is almost a sure indication that this gas escapes into the dwelling; it will be more decided in one room than another, and this fact may help us in its detection, even if that room eventually prove to be distant from the actual leakage—a greater draught up the chimney, a free passage beneath the floor, and similar causes frequently producing such an effect.

If one room is thus affected a larger fire than usual therein will increase—and if no fire be lighted there for a day or two it will ameliorate—the evil. A large fire then made in an adjoining room will perhaps cause its removal to that room, when it may be concluded that the defect is in some spot from which there is free communication, beneath the floor or otherwise, to the two apartments. If it does not so remove to the second room, of course the reverse is the case. It will frequently be found that the floor is continuous with that, or with the roof of a water-closet, or of a place over such water-closet, and this often-overlooked fact will lead to the detection of many a source of the vile exhalation. The partition between the two rooms subject to examination may be over a similar partition communicating with the floor at a lower level, or the gas may travel behind the skirting boards of the rooms and of the corridors leading thereto, which, when followed systematically, will conduct to some free passage into or over the water-closets. These conditions may be infinitely varied in detail, although the same in principle everywhere, and they may be absent altogether from the house in question. Then let it be ascertained if pipes of any kind are hidden in the walls or beneath the floors, and see if there is a rain-water pipe near to the window of either room. Failing all these it may be fairly concluded that the nuisance arises from some one or more of the other causes than sewer-gas, and which will be treated of presently.

The discolouration of paint is a sure test of an escape of sewer-gas, especially white paint, which is turned by it to a nearly black colour almost immediately; signs of this and their locality will afford ready evidence of the proximity of a defective drain, valve, or trap. The skirting boards and pipe casings in water-closets, the painted lids of cisterns having waste pipes, and the joints of painted rain-pipes are most frequently discoloured in this way.

Every householder should make himself thoroughly well acquainted with the nature and position of every drain and pipe in and about his dwelling.

An escape once known to exist in a house it is the best and cheapest plan (as proved in hundreds of cases) to thoroughly grasp and remedy the evil. Let there be no patching, for where one faulty spot is to be found, whether arising from careless workmanship, bad material, or the lapse of time, there are, or soon will be, more. First, lay bare the drain (along its whole length if beneath the house), cut off every single pipe connected therewith both inside and outside the dwelling, and effectually repair the points of connection, also all the joints exposed. The drain will then be safe, and the severed pipes —thoroughly overhauled also—must be carried out beyond the external walls. In the most convenient places, outside the walls, make simple cesspools connected with the drains—let them be furnished with traps and gratings a few inches below the surface, and be bricked round to form small cisterns, which will thus have the gratings at the bottom, and which can be covered with other gratings if desired; but these will be unnecessary. Into these small cisterns the pipes must discharge, and they also will then be safe—for any gas arising and forcing its way through the trap will escape into the open air. This arrangement will to some extent ventilate and harmlessly relieve the pressure in the drains, but the soil-pipes also must be ventilated. It rarely is the case, but all soil-pipes should, if practicable, descend outside the walls—in any case a ventilating pipe of good size ought to be attached to the uppermost part of them, and be carried up outside at least to the level of the roof. This pipe should be bell-shaped at top, and be covered with a perforated lead cap to exclude the birds—its purpose is to carry off all gases that rise from the drain up the soil-pipes, and which would otherwise force their way through the closets into the dwelling. The closet apparatus should be kept in perfect order even then, or a portion of the gases will come through, in preference to flying off by the ventilating shaft. Each rainwater-pipe, also, should discharge over a small cesspool similar to those above described—those at the foot of rainwater-pipes can often be made available for the sink and waste-pipes also. These remedies are expensive, and, for other reasons, will sometimes be found inapplicable, but they form a standard of excellence which should be borne in mind in all attempted remedial measures, as a something to be desired for the sake of life and health, even if not always easy of attainment.

GAS.—The word "gas," when used by itself, is understood to indicate the carburetted hydrogen employed in the lighting of our streets and dwellings. Of the form and origin of gas in its proper and useful sense little need be said here—invisible, it is far from being imperceptible—its vile odour is not to be mistaken, and herein lies our safety in its use. For gas is a dangerous if a useful agent; kept under strict control it serves us well in many ways, but once free to roam about our dwellings it robs us of our health, and even deprives us of our life. Instances of gas-poisoning are comparatively rare, owing, doubtless, to its timely detection by the sense of smell; but once the poison is thoroughly absorbed into the system, the patient is generally considered beyond all hope of cure. And the danger arising from gas takes another form—it should be more generally known that common gas, when mixed with air, is highly explosive, and that a lighted match or candle, carried into a room where an escape occurs, may cause the mixture of gas and air therein to blow up like gunpowder.

Many people suffer greatly from being even for a short time in a room lighted with gas, and especially so if the gas be impure. It is considered impure when it contains an undue proportion of sulphuretted hydrogen, which, in its combustion, produces a sulphurous gas highly injurious to the organs of respiration.

The simplest test for sulphuretted hydrogen in gas is to expose to a jet thereof a paper dipped in a solution of acetate of lead, which will immediately turn black if the suspected ingredient be present.

The leakages most difficult to discover are those caused by nails driven into the wall having pierced the soft metal tubing hidden beneath the plaster; these can be detected only by careful search, aided by a little intelligent reasoning, and, perhaps, experiment. Sometimes it will be found necessary to sever a pipe of the kind at its nearest exposed part, when the workman by "sucking" can tell if there be a leakage in the buried portion of the tube.

A leakage having been discovered, its repair is so simple a mechanical matter as to require no comment, but a few hints on the appliances for the consumption of gas in a house may not be out of place here. We frequently put up with an evil that at the time may, perhaps, appear trifling if the obstacles in the way of its removal are great or numerous; it behoves us therefore to facilitate, by forethought and preparation, the operations attendant upon the adoptions of remedial measures. For instance, we should, as far as possible, make ourselves acquainted with the course of every gas-pipe; and the floor-boards over them ought to be, in every case, fastened down by screws instead of nails, that the pipes may be the more easily examined. If not done before, let this suggestion be acted on after searching for and finding out a leakage; its additional cost will be slight, and more than saved if occasion should demand their second removal. The practice of burying gas-pipes beneath the plastering is a mistake; it should be avoided as such, and the hidden pipes, if taken out for examination, should be refixed where more open to inspection. Keep your gas pendants properly supplied with water; the gas-man will show you how it is to be done. In every house where gas is not required during the day, let it be turned off at the meter, at night by preference, but at all events the first thing in the morning.

DECAYING ORGANIC MATTER.—Numerous as are the cases in which unwholesome smells in houses have been found to proceed from decaying matter, animal and vegetable, it is a source of surprise that they do not still more frequently occur. In every town thousands of rats and mice must perish in the course of a year, and of these a great proportion in the houses, although the majority, doubtless, get away from their usual haunts to die in gardens, sewers, and out-of-the-way places; and as their bodies decompose, gas is given off, which, fortunately, is of so pungent and unpleasant a nature as to render imperative a search for and removal of its offensive source. This nuisance is much more constant than that arising from either sewer or common gas; it is also different in kind and in its effects. Rats are the agents in the production of another similar nuisance; they will, when opportunity offers, collect a large hoard of vegetables or fruit from a store to which they may have obtained access. No smell is for a time much more unpleasant than that of vegetable matter decaying in a damp place, apples or potatoes for example, and of these one rat will carry away many pounds weight in a single night. Rats delight in a home under the basement floors with runs in the earth beneath, especially if a communication can be effected with a neighbouring drain, but they will also take up their abode between the floors and ceilings at a higher level.

Cats are not unfrequently found dead in odd corners, behind packages, in coal-holes, copper furnaces, and even in chimneys. Birds also get into our dwellings and die, often causing much trouble and annoyance.

The sense of smell is generally sufficient for the detection of these nuisances—indeed, the air of a room beneath or in which they occur is, for a time, almost unbearable—removal of floor-boards, skirtings, and sometimes hearth-stones and fireplaces will be necessary, as decided in each case by its own particular circumstance.

Removal of the decaying matter and the plentiful use of disinfectants are the only remedies required—the diluted Condy's Fluid or carbolic acid being freely sprinkled about the place from which the nuisance originated. Stop up with broken glass bottles all holes made by rats found in searching the house; if possible discover their principal means of entry, and with bricks and cement bar their future ingress. A little tar run into their holes will drive away rats for a long time, but this can be done only in cellars and outhouses. Abstain from using poison for rats, or the nuisance spoken of is sure to arise; and let all cats, on arriving at such an age that they cannot long survive, be destroyed, or they will surely get away to some secret place to die.

PAPER ON WALLS.—Another prolific source of unpleasant air in a room, and somewhat analogous to the above, is the slovenly practice of re-papering walls without previously removing from them the old paper. In some houses five or six, and even more, layers of

paper are to be found, stuck together by as many layers of paste, all in an advanced stage of decay, and which, when suddenly removed, have a most offensive smell.

DAMP.—There are some houses so constructed, and others so subject to unfortunate influences, as to be in a state of perpetual although invisible fog—they are haunted by the evil spirit of dampness, everything within them coming under its baneful sway. On entering such a house you feel inclined to draw your coat or wrapper more closely around you, and you certainly escape from the chilling atmosphere at the first opportunity. Notwithstanding the cheerful fires the rooms are cold, the chairs are damp, the curtains hang in straight ungraceful folds, the pictures are hidden beneath a dewy covering, and the pier glasses fail to reflect the misty wretchedness. Nay, the very fires seem to swell the evil, by drawing the damp from out the walls, and to increase the chilliness by quickened evaporation.

There are certain remedies which can be tried for houses built in damp situations sometimes, but not always, with success. If the building be on a wet sandy subsoil, and the relative levels will admit of a drain lower than the foundations and emptying itself into a ditch or water-course, it will carry off a great deal of the water, and the dwelling will be drier in consequence. Sometimes a well sunk through the wet subsoil, and the (probable) impervious bed beneath it, will considerably lessen the quantity of water retained near the surface, and in proximity to the foundations.

A house built on the inclined surface of a stratum of impervious clay or brick earth will receive more than its due share of surface water, which must be intercepted and diverted on the upper side of the dwelling by a channel or depression, and which will mitigate the evil.

For houses damp from temporary and accidental causes the remedies are more simple; the repair or enlargement of a gutter, the replacement of broken tiles or slates, the alteration of a cistern, the removal of a defective pipe, &c., being in most cases all that is required.

SMOKE.—It scarcely comes within the scope of this paper to treat of the smoke so frequently found in and earnestly wished out of our dwellings, therefore a few brief remarks only will be made under this head. Although undoubtedly a nuisance, it is, perhaps, neither actually unwholesome, nor directly an originator of disease, but it is very destructive to comfort and to property. In many cases the propensity of chimneys to send their contents downwards instead of upwards seems really incurable, still a "smoky chimney," *i.e.*, a chimney with an occasional down draught, does not greatly contribute to the risk of fire in our dwellings. But when the smoke finds its way from the flues into the rooms or passages without coming through the fire-places, it indicates the presence of openings that, however small, should not exist therein, and which are unquestionable sources of danger. A room or corridor perhaps becomes filled with smoke, there being no fire on the floor where the smoke is found, or in a house where "smoky chimnies," as such, are unknown. Careful search by experienced persons will establish the fact of its coming from a flue belonging to a fireplace at a lower level through some crack or defective joint in the brickwork, or it may be where the end of a floor joist has been built into the chimney, or a wooden plug driven in for the purpose of fixing stair-cases, skirtings, door-frames, shelves, and so on. Such things have no business to be, but they are nevertheless, and are highly reprehensible, not merely for the discomfort and annoyance they produce, but for the risk of fire occasioned by dry woodwork being placed in such dangerous positions.

We have drawn so largely on this little work of thirty-two pages that we must content ourselves with stating that it contains much other information as to remedial measures; also as regards sundry nuisances and ventilation.

Hints and Facts on the Origin of Man and of his Intellectual Faculties. By Pius Melia, D.D. London: Longmans, Green, and Co. 1872.

LITTLE as we desire to occupy our limited space with matters of speculative thought, we cannot avoid devoting some portion of it to such a deeply interesting subject as that which forms the subject of Dr. Melia's little work.

To all persons who, like ourselves, are practically acquainted with the fact that experimental and practical science supplies full occupation for mind and time, and hence refrain from bestowing much time or thought on metaphysical and speculative science, this book must prove a complete *vade mecum*, seeing that it contains a comprehensive summary of the various theories on the subject.

Although, as might be expected, Dr. Melia takes the orthodox view of the question, he has, with great impartiality and considerable ability, presented us with a most complete view of the various theories on this question whether ancient or modern, and this too in a succinct form.

Of the various theories of the Origin of Man, perhaps those of the ancients are more curious and interesting than such as find favour in modern times; as to these theories Dr. Melia says:—

"The Greeks, from whatever region they came, do not appear to have brought with them any tradition on this subject: hence their philosophers had antagonistic opinions about the origin of the world and mankind. Thales of Miletus stated that everything is derived from water. Anaximander held that the universe, being of an unlimited nature, produced the elements, which constitute the formative matter of all existing things. Anaxagoras affirmed that little particles were dropped down from the infinite matter; these were at first mixed together in confusion, but afterwards arranged by an infinite mind. Anaximenes stated that all definite natures, earth, fire and water, are derived from the air, supposed to be infinite; these combined gave origin to all other things. Empedocles held the same opinion. Parmenides and Heraclitus derived everything from fire. Plato laid it down that God, from the matter which comprises everything, made this world eternal. The followers of Pythagoras held that all things are derived from the harmony of numbers, and from the points and lines of mathematics. The Stoics declared that the universe, endowed with wisdom and intelligence, made itself and all things, and moves, rules and directs the whole world; that the sun, moon and all stars, the earth and sea, are gods, as all these are in some manner intelligent; and that at last a time shall come when the world shall be destroyed by fire. Aristotle, on the contrary, affirmed that this world was without beginning, and is so perfect in itself that it cannot have an end. I must not omit mentioning the name of Xenophanes, who stated that the moon is inhabited, and that in it are many towns and mountains. Some other writers, as also the famous Roman orator, believed that there were people living at the opposite side of our earth, having their feet opposite to our feet, whence their name Antipodes."

Further on Dr. Melia states:—

"Let us now read the Epicurean system in full from the pen of Lucretius:—

"It is certain that the primary elements of all things did not unite together under any principle of order or mind; nor did they act in concert amongst themselves on the movements to be effected; but as they (the atoms) from infinite time were carried about in every direction by their own weight, and being brought into constant collision one with another, they, through a long succession of ages, tried every mode of combination. After so many attempts which proved unsuccessful, they ended at last with one destined to lead to a greater result, and to give birth to the earth and sea and the heavens and every kind of animals. Then the earth ushered in the age of mortal beings; because, the soil being penetrated with a superabundance of heat and humidity, wombs grew up from the roots of the earth, whenever a suitable place afforded opportunity. When the infants enclosed therein reached a period of maturity, Nature conveyed to them, through channels in the earth, a supply of juice similar to the milk which the female now gives to the child which she has brought forth. The earth gave food to its offsprings, the vapour wrapped them in its mantle: the rich, mossy herbage supplied a bed. With good reason, then, does the earth receive the appellation of our mother, since it is she who has created the human race."

Here Lucretius, after stating that lions, foxes, stags, dogs, sheep, oxen &c., were given to the guardianship of man: "*Omnia sunt hominum tutulæ tradita, Memmi;*" goes on to say: "That the men who sprung up from the bosom of the hard earth were altogether a hard race; their frames were constructed of larger and more compact bones, and more powerful muscles and nerves, thus they were less sensible to heat and cold. They lived on coarse food, and knew no bodily sickness. In many periods of the sun's revolutions they led a wandering life, like that of the beasts of the field. They knew not the art of lighting fire, nor that of dressing their food or of covering themselves with the skins of wild beasts. The fruits which the earth spontaneously bore under the influence of the sun and the rain, satisfied the cravings of hunger. They assuaged their thirst with water from the stream. They reposed beneath the acorn-bearing tree. The woods and the caves of the mountains gave them shelter; and when forced by the inclemency of the weather they laid their squalid limbs among the shrubs. They knew no bond of union, nor ties or relationship. They recognised no law. Whatever prey chance threw in the way of each one, that he seized upon, concerned only to provide for his own comfort and livelihood. Sexual intercourse followed in the woods, either in consequence of mutual inclination, or of the brute force of man, or in return for gifts, consisting of acorns, berries and pears. During this time men fought with wild beasts: sometimes they killed the beasts, sometimes they were torn in pieces. When night came upon them, they laid their naked limbs upon the ground, like the beasts of the forests, and covered themselves with branches and leaves.

"In course of time they began to build huts, they learned to clothe themselves, and discovered the use of fire. Marriage was contracted between a man and a woman, and mutual fidelity was practised, and they learned to know their own offspring. Then human kind became milder in their manners, and a kind of civilised life began. Friendships sprang up and each had neighbouring possessions, none injuring or violating his neighbour's right. . . . Nature had then taught them to express with their tongues different sounds, and utility affixed particular names to objects. . . . To suppose that one particular man assigned the names to every object, and that other men learned from him the first language, is absurd."

The following reasons are added by Lucretius in support of this assertion: 1 If one man be supposed capable of inventing the primitive language, we may imagine that other men possessed the same ability. 2. Because it cannot be supposed that this particular man had any means of making other men understand the meaning of the names invented by himself. 3. Even making this admission, this same man had no authority to compel others to adopt his language. The poet then adds:—

"Therefore as the brutes, though not endowed with speech, yet are led to utter different sounds in accordance with their varied sensations; with a stronger reason we,

must maintain that mortals could apply particular names to particular objects."

Passing from the consideration of ancient views of the subject, those of the moderns are thus summed up:—

With regard to the systems of modern writers, I hope nobody will expect that I should enumerate them all: it will be sufficient for me to give some account of the principal.

I presume that everyone is acquainted with the meaning of the term Pantheism derived from the Greek (πᾶν, omne, θεός, Deus, everything is God). The school of the Pantheists has two sections, the Materialist and the Idealist. The Materialist, in which the name of Spinoza is famous, as the restorer of the old Arabian system, which taught that the general material and existing nature is the only real God. The Idealist, to which the German names of Kant, Fichte, Schelling and Hegel, are more or less attached, holds this general principle, that everything depends on our own mind and conception; that self (ego) is the object and not self (non ego) is the subject; it being implied that self is above everything, nay is the centre, the principle, the source of all things: that Self is the Being itself independent and in every sense free. From that it is apparent that the Materialist and Idealist schools go hand in hand with the Atheists, inasmuch as they deny implicitly the existence of God, His Divine Nature, and His attributes of Creator and infinite Ruler of all.

The name of Jean-Jacques Rousseau is well known. I cannot omit some account of his system In his "Contrat Social," and particularly in his treatise "Sur l'origine et les fondements de l'inégalité parmi les hommes," he declares that the natural state of man is the solitary life, apart from all society, in the forests; like the inferior of wild animals in his food, in his sexual intercourse, in all his instincts, without speech, without reason: that the said state of simple nature must have existed at first, though it has not been found by travellers anywhere, because the very savages discovered by these travellers have society in domestic life, they are surrounded by their wives and children, and generally obey some ruler-in-chief; that the understanding of a man and that of a beast does not differ in kind, but only in degree, more or less; that civilised man is a degenerate creature—that orang-outangs and monkeys may be the forefathers and progenitors of mankind, and that there is no sufficient reason to separate the brutes from man. The above and similar assertions of Rousseau are echoed by Cousin, Dameron, P. Leroux, and scores of other writers, and especially by G. Renaud.

The same Renaud in his work professes and also teaches that the first state of mankind was a savage life, brutal at first, then simply sensual, at last intelligent, so that man by natural development, without any extraneous aid, obtained the great faculty of thinking and speaking, and found the means of conducting himself through life, and thus constituted the moral and intellectual order, so that not only the truths pertaining to natural law, but God himself, are the invention of the wonderful mind of man.

Putting aside two Germans, Goethe and Oken, and others not differing very much from the ideas of Renand, I shall limit myself to the systems of two well-known writers, G. B. Lamarck, who published his system in Paris in 1830, and Charles Darwin of our own days.

Lamarck admits the direct creation of some kind of monad, hardly visible, but endowed with life in the sea. From these monads, by some spontaneous generation and development during an indefinite length of time, far beyond our appreciation, the whole of the organic world, plants and animals, came forth; proceeding gradually from the imperfect to the more perfect state, and this in accordance with the two following principles: 1st, the natural inclination to progressive advancement; 2nd, the efforts caused by external circumstances and their needs. 'Ainsi à cet égard les besoins seuls auront fait naître les efforts, et les organes propres aux articulations des sons se seront développés par leur emploi habituel;' and explaining his system, Lamarck says, that in accordance with the above two principles, man descends from the quadrumana through natural development. A number of the best kind of monkeys being under the necessity of defending themselves, were obliged to stand erect on their hind legs, and thus in time they acquired human feet; and consequently they had their exterior form and the internal organization of their bodies so as to become men. Then by continued efforts in their new developed form they gained the faculty of talking, at first in a confused manner, afterwards through the same efforts caused by their needs they spoke distinctly and by means of articulation. Lamarck having at considerable length explained his system without being able to adduce any real proof of it, tells us that the other not privileged monkeys fleeing to the woods and parting from the society of their changed companions, put themselves in other circumstances, and therefore we cannot see now any similar development in them.

I shall now quote the words of our famous English zoologist, Charles Darwin, who with the great fund of his zoological learning, to a great extent follows the system of Lamarck. . . . But first I wish it to be observed that whatever objections may be raised against some portions of his system, Darwin has no association with the Atheistic School. He, with the highest intellects that have ever existed, clearly proclaims the existence of a Creator and Ruler of the Universe. Now let us hear his system: 'We thus learn that man is descended from a hairy quadruped, furnished with a tail and pointed ears, probably aboreal in its habits and an inhabitant of the old world. This creature, if its whole structure had been examined by a naturalist, would have been classed amongst the quadrumana, as surely as would the common and still more ancient progenit or of the oldand new world monkeys.' 'The quadrumana and all the higher mammals are probably derived from an ancient Marsupial animal, and this through a long line of diversified forms, either from some reptile-like or some amphibian-like creature, and this again, from some fish-like animal.' 'In the dim obscurity of the past, we can see that the early progenitor of all the vertebrata must have been an aquatic animal.' The greatest difficulty which presents itself when we are driven to the above conclusion on the origin of man, is the high standard of intellectual power and of moral disposition which he has attained. But every one who admits the general principle of evolution must see that the mental powers of the higher animals which are the *same in kind with those of mankind*, though so different in degree, are capable of advancement. A great stride in the development of the intellect will have followed as soon as, through a previous considerable advance, the half-art and half-instinct of language came into use: for the continued use of language will have reacted on the brain and produced and inherited effect, and this again will have reacted on the improvement of language.'

Dr. Melia, having passed in review the ancient and modern theories, then places before his readers some very pertinent remarks upon them, from which we quote the following:—

In my opinion it is not advisable to make war on the quiet fields of the metaphysical and natural sciences: inasmuch as the greatest number of the systems above quoted diverge so much from the commonly received ideas of learned men, that to expose them in their obvious bearing and meaning is to refute them: the sentence of condemnation which they bear impressed upon them is readily perceived by any one endowed with common sense and free from prejudiced opinions.

Now I only intend to make a few general remarks respecting them. First. All the above symptoms show the aberration of the minds of men, often men of genius and erudition, when confiding in themselves they do not adhere to the guidance of those general principles which are the foundations of true philosophy. For instance, that a Supreme Being, Creator and Ruler of all the world, exists, must be confessed by all, because there can be no effect without its proper cause; and a perfect and constant order cannot exist in nature without a Ruling Mind. Yet Epicurus and many old and recent followers of him rather admit that all things came forth by chance than acknowledge a Creating and Ruling Power.

Against the above assertion, M. T. Cicero thus forcibly argues:—

"Can, then, anybody be persuaded that little separated atoms, set in motion by their weight and fortuitously meeting together, should have made all this most perfect and beautiful world? Whosoever could think this possible, he in my opinion must also say that an innumerable quantity of the twenty-one letters of the alphabet, cast on the ground in a confused manner, may make the "Annals of Ennius" so that we be able to read them. . . . Now, if it be possible that the concurrence of atoms should have made the world, why, then, should not the same atoms make a porch, a temple, a house, or a town? These require less workmanship and are much easier made.

"Therefore I say that, from the beginning, the entire world was established by the providence of the gods, and is continually directed by them. There is nothing more excellent than the order of the world, therefore it is ruled by the will of the gods. . . . Nor is there anything more excellent than God; it therefore necessarily follows that He rules the world. Whence God is not subservient and subject to any nature; therefore *He rules all nature*."

Second. I remark that many of the above systems contradict one another, which is strong evidence against them; because, out of many things contradictory to each other, if one of them is proved to be true, all others are necessarily false.

The ancient and modern philosophic systems of the origin of man having been considered and disposed of, Dr. Melia proceeds to establish the orthodox theory, which he does in a very earnest and candid manner; but we forbear quotation, as this part of the work is really theological—a branch of learning the SCIENTIFIC REVIEW does not concern itself with.

Gibraltar's Value. By "FAS." London: E. & F. Spon, 48, Charing Cross. 1872.

THIS treatise is written to advocate the cession of Gibraltar. The writer's views will be gathered from the following concluding remarks:—

"Let us then cast the mote out of our eye, let us be wise in our generation, and by exchanging a shadow for a substance, become the honoured possessors of that which would indeed be 'one of the brightest jewels in the crown of Great Britain.' And thinking men must learn to realize that Gibraltar in its present state is a possession which in time of war is worse than useless to Great Britain. But if the political complications to which our resumption of Minorca might give rise appear too terrible to modern statesmen, we must set to work at once to construct at Gibraltar the dockyard before mentioned near Europa Point, to form suitable war storehouses and war barracks, and to reform a great part of the fortifications.

"We, of all nations, cannot afford to sit still and 'hope for the best.' As our property increases in value, and the last annual statistics show to what an astonishing pitch of wealth we have arrived, we must recognize how much we have to lose, and our precautionary measures must cost something proportional to our liabilities. The loss of wealth to the country by the interruption of our great maritime highway to India, for however short a period, would directly and indirectly be very much greater either than the cost of the conversion of Port Mahon into a maritime fortress, or the alternative suggestions for improving Gibraltar.

"When we have recognized this, and acted accordingly, we shall have the satisfaction of knowing that we shall be better able to hold our own in the future, we shall know that if the steed is stolen it was not for want of having shut the door, and we shall avoid the bitter reflection in the days that are to come, that an adherence to idiotic sentiment and to the policy of penny folly had combined to ruin a nation which once called itself 'GREAT Britain.'"

We confess ourselves unable to approve of these suggestions. Our advice is—keep to the Rock, and improve and strengthen it.

Sixth Report of the Quekett Microscopical Club, and List of Members. Meeting at University College, London, on the Second and Fourth Fridays of every Month at Eight o'clock. Offices: 192, Piccadilly, London.

WE notice this publication for the sake of the opportunity for saying a good word in favour of the club therein referred to which enables microscopists and students with kindred tastes to meet at stated periods to hold cheerful converse with each other, exhibit and exchange specimens, read papers on topics of interest, discuss doubtful points, compare notes of progress, and gossip over those special subjects in which they are more or less interested: where, in fact, each member is solicited to bring his own individual experience, be it ever so small, and cast it into the treasury for the general good. In addition the club hopes to organize occasional field excursions, at proper seasons, for the collection of living specimens, to acquire a library of such books of reference as will be most useful to enquiring students; and, trusting to the proverbial liberality of microscopists, to add thereto a comprehensive cabinet of objects. Such an institution is, without doubt, well worthy of the support of men of science, and we wish it a continuance and increase of prosperity.

A Dictionary of Chemistry and the Allied Branches of other Sciences. By HENRY WATTS, B.A., F.R.S., F.C.S., Editor of the Journal of the Chemical Society, assisted by eminent contributors. Supplement. London: Longman, Green, and Co. 1872.

THIS supplement to the admirable and well-known "Dictionary of Chemistry" brings the record of chemical discovery down to the end of the year 1869, including also several additions to, and corrections of, former results which have appeared in 1870 and 1871.

The author states that he has been fortunate in obtaining the assistance of some of the former contributors to the Dictionary, to whom he tenders his best thanks. These contributors are G. C. Foster, B.A., F.R.S., Electricity—Heat; Michael Foster, M.D., Protoids; H. E. Roscoe, Ph.D., F.R.S., Chemical Action of Light—Spectrical Analysis; J. A. Wanklyn, Corresponding Member of the Royal Bavarian Academy of Sciences, Acetic Ether (in part), Butyl Alcohols, Butyric Acid (in part), Ethyl Acetylinated, Ketones; and also our esteemed friend Dr. Benjamin H. Paul, whose contributions refer to Beer and the Metallurgy of Iron. When we say that this supplement is fully equal to the body of the work, our readers will understand that we have said everything that can be said in the way of commendation.

Five Speeches on the Liquor Traffic. By GEORGE OTTO TREVELYAN, M.P. for the Border Burghs. London: Partridge and Co., Paternoster Row; Manchester: A. Ireland and Co., Pall Mall; and United Kingdom Alliance. 1872.

How easy it is to be good when the circumstances and position of men's lives do not tempt them to do evil! Hence none are so ready as those who can avail themselves of the round of pleasures and gratifications of life to make long speeches in support of stringent measures of paternal tyranny for the cutting off of any questionable enjoyments, though they be amongst the very few available to less fortunate individuals.

That alcoholic drinks are much misused no practical observer for a moment doubts; but that their entire disuse is advisable for those who have to lead the toilsome, wearisome lives which the bulk of mankind have to bear with has not yet been proved, nor is it likely to be, until those lords and legislators who now give themselves so much trouble to obtain measures of legal compulsion against alcoholic libations shall have made the homes and social status and enjoyments of the workers to much nearer approach theirs than they now do, or can do, even if the pence now spent on the grog-shop be thriftily placed in some of the investments of the present age, which so often turn out mere swindles.

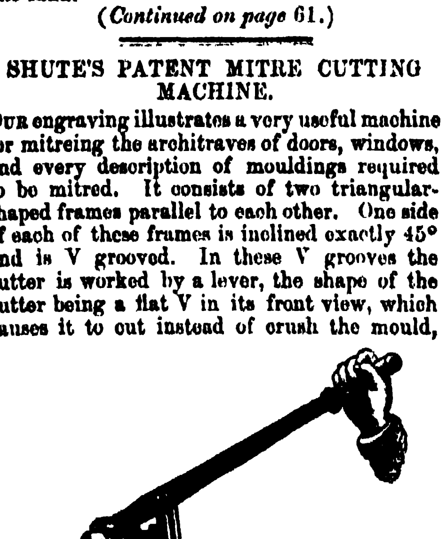
These speeches of Mr. Trevelyan's will no doubt be applauded to the echo by anti-alcohol bigots—men who believe that the whole world can be dragooned into virtue—a theory we hold to be utterly fallacious.

Ever and anon we hear of the power of education, but the temperance men have, it would seem, no great reliance on it. Prohibition and proscription are for them the great regenerators of society; because they are virtuous there must be no more cakes and ale in the land.

(*Continued on page 61.*)

SHUTE'S PATENT MITRE CUTTING MACHINE.

OUR engraving illustrates a very useful machine for mitreing the architraves of doors, windows, and every description of mouldings required to be mitred. It consists of two triangular-shaped frames parallel to each other. One side of each of these frames is inclined exactly 45° and is V grooved. In these V grooves the cutter is worked by a lever, the shape of the cutter being a flat V in its front view, which causes it to cut instead of crush the mould,



so that it makes a fine clean unsplintered joint however delicate the members may be; and as the knife descends at exactly 45°, the mitre must be a perfect one. The advantages claimed for it are, that it will mitre bolection or return mouldings of any pattern without splintering them; that mouldings of any description of wood, from 5½ to 2¼ downwards, can be cut with a clean and perfect fit and a great saving of labour. The patentee is Mr. R. G. Shute, 14, Cook's Court, Lincoln's Inn, W.C., and the makers are A. Ransome & Co., Chelsea.

GOVERNMENT INVENTORS.

THE question of the interest in patent inventions of officers of the civil, military, or naval services, employed in manufacturing departments of the Government, having recently engaged the attention of the Lords of the Treasury, the following minute has been issued from their office:—"The First Lord and Chancellor of the Exchequer state to the board that their attention has been called to the case of officers in the civil, military, or naval service of the Crown, who are employed as superintendents or otherwise in the manufacturing departments, and of those who are employed upon committees of inquiry or otherwise, to judge of plans, inventions, &c., which may be for the advantage of the public service, and they submit to the board that definite instructions should be given with regard to the claims which have been frequently preferred by officers in the manufacturing departments for compensation out of public funds; and with regard to the officers who should be called upon to decide upon the merits of inventions connected with the departments to which they are attached. My lords consider that no officer should be called upon to judge, nor to give an opinion where his own interest may come into collision with that of any other person, and that no inducement should be held out to officers employed in any department of the public service to make use of labour or materials entrusted to them for the good of that service, in prosecuting investigations from which they are themselves to derive any pecuniary advantage, since it is evident that the opportunities enjoyed by such officers must suggest to them improvements, and it is only just that the public, by whose resources these improvements have been worked out, should have the benefit of them. My lords deem it right, therefore, to state that, in their opinion, no officer while so employed should be permitted to obtain, or hold, or be directly or indirectly interested in, any letters patent for any articles needed for the use of the Government; nor to accept or derive any benefit whatever from any person interested as a patentee or otherwise in such inventions, and that no claim on behalf of an officer so employed should be admitted for compensation for such inventions, or for any loss he may allege that he has sustained by being prohibited from taking out letters patent for them."—*Naval and Military Gazette.*

TECHNICAL EDUCATION AND THE CITY GUILDS.

THE master, wardens, and court of the Painters' otherwise Painter Stainers' Company, with a view to promote the important subject of Technical Education in connection with the art and mystery of Painting, have determined yearly, to invite competition in one of the three following subjects:—1st. Alto relievo and decorative Painting. 2nd. Marbling and graining. 3rd. Plain and illuminated writing. And to offer for each subject three prizes, viz.:—1st. The company's silver medal and *freedom of the company*. 2nd. The company's silver medal. 3rd. The company's bronze medal. The prizes will be open to young men under the age of thirty years, residing within a radius of twelve miles from the company's hall. The subject for this year, 1872, will be "Alto Relievo and Decorative Painting." The subject of "alto relievo and decorative painting" may be done either in chalk, water color, or oil, not limited to any subject, and may be copied either from an antique bust, cast of ornamental grouping, decorative moulding, or otherwise. The specimens must be sent to the hall between the 18th and 25th of May, inclusive, and must bear a private mark or motto, and be accompanied by a sealed envelope containing a similar mark or motto, with the name and address of the competitor, and his age, if an apprentice; but in all cases a certificate of good conduct, and a certificate or declaration that he is in the trade, and that the work is by his hands only. The envelope will not be opened till after the judges have made their report. The specimens to remain the property of the competitors, but the company will not hold themselves responsible for the safety of, or damage to, such specimen. The specimens will be exhibited to the members of the court, and the prizes awarded by the company's trade committee, and after the award the prize specimens may be exhibited at the South Kensington Museum, or at such other place as the company may select. Each competitor must remove his specimen at his own cost within one week after notice sent to him by post.—Painters' Hall, Little Trinity Lane, Queen Victoria Street, E.C., H. D. PRITCHARD, Clerk.

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THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON.

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Past President:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868.

Present President:

LORD RICHARD GROSVENOR, M.P.

MEETINGS DURING THE PRESENT MONTH.

THURSDAY, APRIL 11TH.—R. M. LATHAM, Esq., of the Inner Temple, Barrister-at-Law, on the Parliamentary Proceedings on the Patent Laws

THURSDAY, APRIL 25TH.—F. H. VARLEY, Esq., on Inventions relating to Telegraphy.

R. MARSDEN LATHAM, *Secretary*.

Members whose subscriptions are now due will please to forward the same to the Collector, Mr. G. A. Stretton, 4, St. Martin's Place, Trafalgar Square, London.

Monthly Notices.

House of Commons' Committee on Letters Patent.—Technical Education in the City.—Cape Diamonds.—The Government Railways and the Atlantic Telegraphs.

SEVERAL sittings have been held by the Committee of the House of Commons on Letters Patent, which was re-appointed early in the present session, without any further change in its composition from that of last year, except the substitution of Mr. Dease for Sir Robert P. Collier, in consequence of his being made a judge in the Privy Council Court. Amongst other witnesses examined was Mr. Siemens, C.E., F.R.S., a member of the Council of the Inventors' Institute, who gave evidence in favour of maintaining and improving the Patent Laws. He also stated that he had been induced to leave Prussia, locate himself in this country, and bring his inventions here, in consequence of the superiority of our laws as to patents and inventions over those of Prussia. The Committee have likewise examined Mr. F. W. Campin, a member of the Council of the Inventors' Institute, who, having had much connection with working men's movements, was requested to state the views of that class on the subject, which he said were favourable to the maintenance of the Patent Laws in an improved form; what they required being that patents should be granted at lower charges, and that litigation on patents should be rendered less costly and more certain in its effect. Mr. Campin put in a copy of the proposed Invention Right Bill prepared by the Inventors' Institute, which, he said, was generally approved of by inventors, whether working men or others.

We are glad to be able to state that the City guilds have not forgotten the claims of technical education, the Goldsmiths' Company having granted a subsidy of £50 per annum for three years to the Horological Institute towards the support of a technical science teacher in the watchmaking art. The same Company has likewise appointed and agreed to provide a stipend for a teacher of art applicable to goldsmiths' work and jewellery, on the condition that he shall teach a certain number of youths engaged in the trade without charging any fees to them. Another guild (the Haberdashers' Company) has agreed to set aside the yearly sum of £100 for prizes to the actual inventors of new patterns, designs, or specimens of articles of haberdashery proper, such inventors not being manufacturers or dealers. As the Goldsmiths' and Haberdashers' Companies are both of them rich institutions, we hope these are only foretastes of better things yet to come. The Painters' Company, which some years ago held exhibitions of specimen works of the art in its ancient hall, has again come forward with a scheme of prizes, amongst which is the *freedom of the Company*. This scheme is, by favour of Mr. Geo. Saywell, an active member of that guild, fully stated in another column.

A fact which pointedly evidences the necessity for scientific technical education has been brought to our notice by Professor Tennant, of King's College, London. It is this:—One of the Cape diamonds, weighing 63 carats, being originally octohedral with a twist, has, by cutting, been reduced to 35 carats, and is now of the size of a shilling in the girdle or outer boundary. It is a coloured jewel, as, it appears, are most of those found at the Cape.

Two movements of great importance are now in progress; the one is the acquisition of the British railways by the State, in order to the reduction and uniformity of fares. This was the subject of a paper read at the meeting of the Inventors' Institute on the 14th of March, which will be found reported in another column. The other movement is one for the transfer to the Governments of Great Britain and of the United States of the existing submarine cables and Newfoundland land-lines. The head-quarters of this movement is at Mr. Snead's, 21, Mincing Lane, E.C.

ACTS OF PARLIAMENT intended to protect the public against the adulteration of articles of food, drink, and medicine have hitherto failed, or have been at the best comparatively inefficient, owing to the near relation of the authority empowered to put them in force with the trading interests that would be affected. A Bill is now in Parliament, brought in by Mr. Muntz, which aims at providing a remedy against the acts of fraudulent tradesmen. It provides that any purchaser who suspects adulteration may obtain the services of an appointed analyst for a payment ranging from one to five shillings, and may proceed against the supposed author of the adulteration or the vendor of the adulterated article with the certificate of the analyst as a weapon of offence. This certificate is to be deemed conclusive evidence until the contrary is proved, and the cost of the certificate is to be refunded to the prosecutor, together with such other costs as may, in the ordinary operation of the law, accompany a conviction. A distinction is made between adulterating and selling adulterated goods. The author of an adulteration is to be liable to a penalty of £50 and costs for a first offence, and for a second offence to imprisonment with hard labour for six months. The vendor of an adulterated article will be liable to a penalty of £20 with costs, and on a second conviction to have his name and address published, at his own expense, in any way the justices may see fit.

The Inventors' Institute.

CONFERENCE OF COUNCIL AND MEMBERS ON THE PATENT LAW QUESTION.

FEBRUARY 29th, 1872.—Mr. Parkes, Member of Council, in the Chair.

The CHAIRMAN explained that in consequence of Mr. Rogers being unable to attend to read his paper on "Saving Life at Sea," it had been resolved at the Council Meeting held that evening, on the motion of Mr. F. W. CAMPIN, seconded by Mr. M. M. HARRIS, that the question of the position of the Institute with regard to the Patent Laws should be discussed by the Council in a conference with such members as might feel inclined to take part in it.

Mr. PARKES said he thought that the Patent Law must be supported. For his own part, although he had suffered wofully by the bad state of the law, having been pillaged by barefaced infringers without being able to obtain legal redress, he preferred having a bad law to no law at all. He considered that inventors wanted cheap patents and real protection. At present patents were dear and delusive.

Mr. LATHAM explained that the Inventors' Institute contended that nothing beyond Government office expenses ought to be paid. In point of fact he thought it would be good policy for the State to grant patents free of cost; but as this might be considered Utopian, the Institute only made the moderate demand he had mentioned.

Mr. MACNAIR, Mr. M. M. HARRIS, and Mr. SHUTE suggested that the Parliamentary Committee of the Institute should, when attending to watch the proceedings of the House of Commons' Committee on Patents, be accompanied by such other members of the Institute as might be inclined to attend. This was agreed to.

Mr. CAMPIN said he was much pleased that he was present at this meeting, for he expected to be summoned as a witness before the House of Commons' Committee, and the opinions he had heard expressed that evening would be of great value to him in shaping his views as to what inventors required to be done in the matter.

ON THE PURCHASE OF RAILWAYS BY THE STATE, AND UNIFORMITY OF RAILWAY FARES.

By Raphael Brandon, F.R.I.B.A.

MARCH 15th, 1872. — Campbell Johnstone, Esq., F.R.S., presided at this meeting, and opened the proceedings by stating that the question of purchase of railways by the State, and uniformity of fares, was of great interest to him, and he was convinced that by means of a well-organised railway management uniform fares, for any distance, of one shilling and under, or for distances under 10 miles, of fourpence and under, as proposed by Mr. Brandon, might be carried out.

Mr. BRANDON, in a very able manner, reviewed the present condition of railway property and railway travelling, showing that in order to manage the railways in the most economical manner the Government must take over the whole of them. He stated that the mere fact of amalgamating all the railways would result in enormous yearly gains; which had been estimated by Mr. Charles Stewart, who was for twenty years secretary to the London and North-Western Railway, at 10 per cent. on the gross receipts, or £4,000,000. He believed it would be more, but in making his calculations he would assume his estimate to be correct, which important annual saving could be thus effected. In the first place, the *valuable* services of nearly 4300 directors could be dispensed with, and they would be replaced by *one* central board; but amalgamation would also tell strongly in the saving of other expenses; for instance, stocks of rails, sleepers, chairs, and other necessaries for permanent way, stock and plant in repairing shops, rolling stock, staffs of employés, all the expensive and complex machinery of the clearing-house, separate accounts, diverse and often contradictory systems of control, and a large proportion of legal and Parliamentary expenses —which latter alone amounted to more than £19,000 a month during the six years 1861 to 1866—might all by judicious management be reduced and simplified so as to form large items of saving. Again, towns which possess two, three, and even more competing stations, with their separate staffs, could, if the railways were amalgamated, be equally well and often more conveniently served than at present, by one, and a great saving would thereby necessarily be effected. Another great advantage that would accrue to the country, both as regards convenience and economy by the Government having the management of the railways, would be that each station would become the central point for the Post Office, with all its various branches, including the telegraph. Further important savings would be effected by the Government guarantee of the interest on Debenture Loans, &c., which would be equivalent to at least 1¼ per cent., equal to a gain of more than £1,500,000 per annum.

Mr. Brandon stated that the average fares at present charged were as stated in the subjoined tables —

For a distance of 100 English Miles.

English Companies—	1st cl. £ s d	2nd cl. s d	3rd cl. s d	4th cl. s d
1 South-Eastern	1 5 1	16 10	8 1	8 4
2 Great Eastern	1 0 10	16 8	12 6	8 4
3. Great Northern... } 4 Midland ... } 5. North-Western ... }	0 18 1	13 4	8 4	8 4

These are the average fares.

Foreign Companies—				
6 France	0 14 4	10 9	7 11	None
7. Italy	0 11 1	8 4	4 2	2 6
Foreign State Lines—				
8. North Germany (new tariff)	0 10 5	6 4	1 2	2 1
9 South Germany	0 10 9	7 2	4 9	None
10 Belgium	0 4 6	3 0	2 3	None

These are the maximum fares.

His project, however, went far beyond even the advantages enjoyed on the Continent. What he desired, and felt confident to be quite practicable, was the establishment of uniform fares, irrespective of distance, which would enable a passenger to travel one journey in any direction, and of any distance by the ordinary trains for

One Shilling	Sixpence	Threepence
First Class.	Second Class.	Third Class.

The parliamentary returns show that during the year 1867 (which is the last year that we have any reliable information upon which to base our calculations (for no general summary was published for 1868 on account of the incompleteness of the returns, and that for 1869, either by accident or design, was so grossly incorrect as to be almost worthless) passenger trains to the number of 3,924,624 run over 74,886,409 miles, carrying (exclusive of the season ticket holders) 287,688,113 passengers, and produced £15,316,981. This gives an average of rather more than 19 miles and 73 passengers for each train, the average fare paid by each passenger not being a season ticket holder a little more than 1s. The cost of working the trains will be seen by the following statistics, extracted from the parliamentary returns :—"The total working expenses, comprising the maintenance of way and works, locomotive power (including stationary engines), repairs, and renewals of carriages and waggons, traffic charges (coaching and merchandise), rates and taxes, Government duty, compensation for personal injury, &c., compensation for damage and loss of goods, legal and parliamentary expenses, and miscellaneous working expenditure not included in the foregoing, amounted in the year 1867 to £19,848,952." This was for goods as well as passenger traffic. It must be remarked that the former are much the more expensive, as being of extreme weight, and requiring the employment of large numbers of porters at all the sidings and termini for the loading and removal of their entire freight. However, for the sake of simplicity, it might be considered that they all cost the same proportion. The number of trains run, for the joint traffic, was 6,328,490; the average cost per train was therefore £3 2s. 8¼d.

Notwithstanding many inconveniences, and the very insufficient accommodation grudgingly set apart for the use of the despised third class passengers, they are, as will be seen by the following table, by far the largest contributors to the receipts:—

	1st Class.	2nd Class.	3rd Class.
1867.	£3,979,501.	£4,985,416.	£6,432,064.

With such results it might very naturally be imagined that the facilities for travelling held out to the third class passengers were greater than to either of the superior classes, whereas the *very reverse* is the case. First and second class passengers can travel by every train, at their option—not so the third: their trains are few and far between, and it is not uncommon to find trains with third class carriages attached that will not take that class of passengers, who is thereby vexatiously forced either to waste his time or spend more money to travel in a superior class.

Numerous other examples throughout the whole country might be cited to show that the *best* supporters of the railways are the most ungenerously treated, and yet in the face of such facts Mr. Allport, who boasts to be the oldest railway manager in the kingdom, asserted at a public meeting that the companies have done all they could for the third class passenger. *Possibly*—but, if so, the sooner managers with such notions are relieved of their duties the better it will be for the railway shareholders and the public.

Lest he should complicate his paper, Mr. Brandon avoided entering upon calculations respecting the goods traffic. Doubtless, it would increase under a somewhat similar system of rates, but he did not think it would be likely to increase in the same proportion as the passenger traffic. A bale of goods, an ox, or a sheep performs but one or two journeys, whereas a passenger travels day after day. An increased goods traffic, moreover, though producing increased profits, necessitates some considerable increase of expenses, in the employment of porters, storage room, &c., while the passengers, provided with their tickets beforehand, simply require to be conveyed from station to station.

The only case at all similar that can be quoted in favour of Government taking the conduct of the railways, is that of the Post Office, with its various branches, including the telegraph, all of great benefit to the public, and financial successes; though this is not quite an analogous case, letters requiring much more than being simply carried from place to place they have to be collected, sorted, examined, weighed, stamped, placed in their proper bag, re-stamped at the end of their journey, and delivered as addressed; whereas, a passenger, provided with a ticket beforehand, places himself in the train, and leaves it at his own expense: so that the comparison is all in favour of railway amalgamation by the Government. Again, the proposed reduction in the fares is much less violent than was the reduction in the rates for postage: when the uniform charge of one penny for a letter to any part of the kingdom was suggested, the average charge for a letter was 8¼d. The existing average fair paid now by a railway passenger is only about 1s.

Ireland is now quite alive to the advantage it would derive from Government purchasing the railways, and at least four important deputations have been received by the Lord-Lieutenant urging that course.

Several useful reforms have been advocated with regard to the management of railways, and it would be unfair to their authors not to make mention of them: thus Mr. H. B. Sheridan, M.P., has conferred an immense benefit on all travellers by the introduction of smoking carriages to every train; and Mr. S. Plimsoll, M.P., deserves the especial thanks of all for his proposal to carry out in this country the comforts that are enjoyed in Germany, where even third class carriages are well warmed in

winter, and, though his proposal in the House of Commons was first received with that ridicule which is the ready weapon the opponents of progress oppose to its advocates, if he only perseveres in his public-spirited endeavours, he will be certain to achieve success. All these improvements are but the forerunners of more important reforms. Our railways are now virtually monopolies: there can be no competition against them, but the monopoly secured to them was only granted for the public good, and the same power that granted it to the companies can and will deprive them of it, if requisite, for the benefit of the nation.

Mr. Brandon having concluded, the CHAIRMAN invited discussion.

Mr. MOTTERSHEAD said he did not object to Mr. Brandon's statistics. He would accept them on his own responsibility; but the very principles of good government would be involved in the practical realisation of the scheme of purchase of railways by the State, which really meant neither more nor less than communism. No doubt the railways were monopolies; nevertheless, he thought it was necessary that we should well consider the effect of this proposed change as another step to centralise government. The Poor Laws had been made onerous and expensive by centralisation, and many other evils resulted from that system. He felt great difficulty on this point. Moreover the immense patronage which would be placed in the hands of the Government would be a source of corruption and danger.

Mr. TOOTH considered that the plan of centralisation would be very injurious to our commerce. At present, if we found any difficulty occurring in railway transit, we could go to the secretary of the railway, and were always met with civility and attention. Under Mr. Brandon's scheme we should have to deal with upstart Government officials. He had always found railway directors and secretaries attentive and considerate.

Mr. STURRIDGE did not think we need fear the intervention of Government. The Post Office and the telegraphs were models of good management.

Mr. MACCOMBER came to the meeting opposed to the proposition of Mr. Brandon, but felt convinced that if carried out it would be a great step in the progress now making for the benefit of the masses. Englishmen need have no jealous feelings as to Government action. What with the power of the press of this country, which was very great and was very judiciously used for the benefit of the people, and the power of meeting in public for the redress of public grievances, he thought no great malversation could long go unchecked.

Mr. HUMPHREYS said there was one country where the governmental system was similar to our own, namely, Belgium. There they saw low fares, and they were found to be profitable. He had assisted Mr. Brandon in his calculations, and felt proud of it. There was a tendency towards combination and amalgamation amongst the railways, and if not transferred to the Government they would become the subject of a gigantic monopoly. The Post Office and the telegraphs, which are receiving offices, are, like most receiving departments, generally pretty well managed. It was the spending departments, such as the War Office and the Admiralty, which were so wofully mismanaged.

Mr. M. M. HARRIS could not help saying a word in favour of the Government officials of this country. He had always found the officers of Government civil and attentive; and he made no doubt that when the railways came under the charge of the Government, they would find the action of the officials satisfactory.

Capt. SELWYN thought the foolish opposition to the railway system formerly adopted by the landholders, had been the main cause of the great expense of making them, and had rendered railway travelling so expensive as it was. He did not object to the proposed transfer to the Government, but care must be taken to get a fit and proper man to manage them. Political motives must not be brought into operation in such an appointment. Good Government arrangements would prevent money being wasted upon competing lines instead of being used to develop the resources of those already constructed.

Mr. VARLEY said that the telegraph system had been vastly improved since it had come into the hands of the Government. Under the old system rivalries existed that effectually stopped improvement; now improvement and progress were the order of the day.

Mr. CAMPIN thought Mr. Mottershead was right in referring to the gravity of the proposed change; nevertheless, he considered that it was one we should find ourselves obliged to effect. To his mind the objection that the working of railways by the State was wrong because it would be engaging in trade was a groundless objection. It was rather a matter of facilitation of the internal communications of the country, and he maintained this was a legitimate duty for the Government to undertake. Good means of transit was of the utmost importance to the State politically and commercially, but he hoped the public would keep a strict watch over the Government, and not allow railway servants, like postmen, to be badly paid, or, like telegraph servants, to be prohibited from associating together for the advancement of their interests.

Mr. CARTTAR did not fear that Government would be allowed to forget their proper position and duties. Public opinion was too strong for that. He thought that the reduction of railway fares would enable workmen to seek the best markets for their labour, and would thus conduce to their prosperity, and tend to reduce pauperism. He pointed out that the compulsory purchase of the railways by the Government would be a very heavy financial operation.

Mr. BRANDON replied that his answer as to the Government difficulty was that the Government was the servant of the State. He felt sure that all the railways were drifting into the hands of one company, which he thought would be a great evil, as the patronage would be immense. With regard to Mr. Carttar's remarks he would merely state that it was not proposed that the Government should purchase the railways' interest out, but should issue bonds bearing interest

Capt. SELWYN moved, and Mr. CAMPIN seconded, a vote of thanks to Mr. Brandon and the Chairman, which was passed by acclamation.

The CHAIRMAN having briefly returned thanks, the proceedings were brought to a close.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

AT the meeting held on March 12—T. Hawksley, Esq., President, in the chair—the paper read was "On the Soonkésala Canal of the Madras Irrigation and Canal Company," by Mr. J. H. Latham, M. Inst. C.E.

The object of this communication was to give a general description of the canal between Soonkésala and Cuddapah, recently constructed for irrigation and navigation by the Madras Irrigation and Canal Company; and to direct particular attention to the mode of safely constructing high banks for canals or tanks illustrated by that work.

It was remarked that the countries possessing the greatest powers of production were those in which the yearly rainfall was concentrated into a few months. Settled warm weather was the safest for crops at every stage of their sprouting, growth, and ripening; and, not only in England, but in India it was found that crops grown during uncertain weather, as all unirrigated crops must be, were nearly as often severely injured by rains or floods as by drought. To fully develope the productive powers of land three things were needed: firstly, settled weather, which art could not give nor control; secondly, irrigation, which must be controlled by art; and lastly, manure.

Of the native engineering works in the Madras Presidency those for the application of water to irrigate fields and gardens ranked the first, both in magnitude and importance. Of these there were three kinds, viz., wells, tanks or reservoirs, and river channels. Of the latter full details were given, and it was remarked that, while the rebuilding of the Nellore Aniout, since it was last carried away, was making progress, the Toombuddra project, of which the Soonkésala Canal was a portion, was adopted by the Government. This was designed to serve two purposes: first, the continuous irrigation throughout the year of three large areas, of which the principal lay in the Bellâry District, the next in the Koonder Valley, and the other in the Nellore District. The second purpose, apparently necessary to the success of the first, was a means of communication by canals, by which the produce of those areas could be sent to a market more cheaply than by cart or railway—more expeditiously than by cart and more securely than by railway. The project was originally brought forward by Colonel Haviland, but it was not till 1858 that the Madras Government, on the report of General Sir Arthur Cotton and other engineers, selected it as the first work to be undertaken by the Madras Irrigation and Canal Company, and assured the shareholders of the co-operation of Government by guaranteeing 5 per cent. on the first million of capital raised by them. In 1861 the Government limited the work of construction under the guarantee to the canal between Soonkésala and Cuddapah, and the weir at Somêshwaram; and in 1866 made terms with the Company for completing the canal between Kurnool and Cuddapah by the 1st July, 1871.

The canal began at Soonkésala, with a weir across the river Toombuddra, 1500 yards in total length of clear overfall, which was broken into two lengths by an intervening island. The weir stood upon the rocky river-bed, and was formed of three patterns, viz., 1st, of solid rubble masonry of gneiss, trap, and quartzite boulders; 2nd, of gravel concrete, with gneiss rubble facing in front and rear, 3rd, all recent portions were of solid gneiss rubble masonry, with a facing on the lower side of Kurnool limestone ashlar, which averaged ⅔ yd. thick where exposed to concussion. Patterns Nos. 1 and 2 had a front and rear batter of 1 in 8, while No. 3 had an upper batter of 1 in 4, and a rear face vertical. All were 8 ft. broad at the top, and coped with dressed limestones 1 ft. thick. The mortar throughout was of Kurnool kunkur, except the joints of the coping, which were of Portland Cement. The coping was joggled wherever the Aniout (which was not straight, but followed the line of highest solid rock) was concave in plan on the upstream side. No part of the Aniout formed on any of the above patterns, either with or without the coping, had ever failed. The height varied from 6 ft. to 26 ft., and averaged about 18 ft., and the highest registered flood rose 7½ ft. over the crest. From the pond above the Soonkésala weir the water was admitted into the canal by a head-sluice without any lock. The face of the head-sluice was kept clear by the scour of ten under-sluices at a lower level in the weir, the stream to which was forced against the front of the head sluices by a long curvilinear groin. From this natural main supply channel the water was taken at four points, viz., at Lockinaula, Jutoor, Rájóli, and Adinamayapully, by the simple process of throwing weirs across it, with under-sluices in the weirs to keep down the silt, and head-sluices across the channel to control the supply, and entrance locks.

Besides the weirs, some of the masonry works on the canal deserved notice. The Hindry Aqueduct carried the canal, 90 ft. broad and 8 ft. deep, clear waterway, over that river, at an elevation of 32 ft., by 14 40 ft. arches, the length between the abutments being 651 ft. The lowest headway, at full water, under any bridge over the canal was 15 ft.; the smallest width, in locks, was 20 ft. There was a width of 30 ft. under bridges, except in two cases, where it was

25 ft. The filling and emptying sluices of the locks were a pair to each pair of lock gates, *i.e.*, four to each single lock. Each sluice was 4 ft. square, clear opening, and the ratio of the inlet ports to the sluice and to the outlet ports was as 5, 4, and 8 respectively.

The grade, or fall, allowed the canal where it was taken down the irrigating channel varied between 18 in. a mile in one or two heavy cuttings, and a level in the tanks formed where the canal was carried over an open valley, by damming it across. In other places it was usually from 4 in. to 6 in. a mile. No measuring sluices were needed. Two sizes of sluices for irrigation were used, besides some small ones, closed by hand, in the first three sections. The smaller size was 18 in. wide and 1 ft. lift, worked by turning round a vertical screw lifting a cross-head, to which the cast-iron shutter hung. The larger ones had 3 ft. 9 in. lift, and might be 5 ft. broad, the shutter being made of wood and raised in the same way.

Though the masonry works, and especially the weirs, contained a great variety of work, the chief interest and novelty in the construction of the canal were undoubtedly the mode of forming the banks. These ranged up to a height of 50 ft. from the ground surface of their site to the water line. In all cases single banks were revetted or shingled on the inner slopes. The formation of the banks was various, comprising lengths of simple filling, of masonry wall, of masonry face wall, of masonry revetment, of puddled bank, and of puddle-core bank, in different sections of the canal. The masonry wall, masonry revetment, and puddle-core bank came into the author's hands in 1865 as finished works, but had since been strengthened or raised. The strongest and best sections were the masonry face wall and the puddled bank, adopted after the experience of two seasons in the working of all kinds. The author estimated the efficiency of these as so equal, that the choice between them might be a question of cost. The only objection to the face wall was that it could not easily be raised when once built. No portion of this face wall had cracked or shown any signs of weakness; nor, though unprotected in front by either plaster or puddle, was the leakage more than just sensible. The puddled slopes were even tighter than the face wall, and had proved efficient even when the bank was of the worst kind of white and gray clay, mixed with salts of lime and soda, and such as to absorb water readily.

Some remarks were then offered as to the probable stability of a bank composed of any soil thrown up without either selection or puddling, when first exposed to water; and the mode of meeting the two dangers, of slips and leaks, to which a bank was exposed, was described. The consideration of the problem, how to construct earthen dams of a great height which could neither slip nor be cut up by leaks, was discussed at some length; and it was remarked that, in practice, the best position for the puddle was on the flattest slope in front of the bank, where it should be protected by rubble, the larger and smoother the better, laid on sharp loose gravel impervious to vermin. The thickness of this protection must be so great that it could not be wholly removed as the bank settled. Rubble packed, or very rough stone, as kunkur, was best avoided, as it would not follow the bank during settlement. The puddle would be the most dense part of the banks. Where used by the author, the surface of puddle under construction was always kept flooded, like a rice-field; and gangs of men, with their arms linked together, walked backwards and forwards on short lengths of it all day, treading it stiff, as layer after layer was added by the contractor's workmen. In order to ensure the puddle remaining water-tight under all circumstances of original settlement, and of alternate wet and drought, it was desirable that it should rest on a substance rather more compressible than itself. To lay it at once on ordinary rammed filling would be too violent a change, and it had always been laid by the author on a cushion of earth, moistened and rammed; each layer, of 6 in. or so, being well wetted, and then sprinkled with enough dry earth to prevent it sticking to the rammer when punned with a rammer of 40 lb. weight. The rest of the front slope, if not already existing, had been made of earth rammed dry in the usual way; since it was found safest, indeed almost necessary, to establish the broad rule, that nothing but earth should be brought to the front of the centre line of the bank. The bank was then completed of any gravel or bad soil available, the gravel being kept at the bottom as much as possible, and the finest soil to the centre. Though such banks were not theoretically perfect, they had never failed, nor given trouble upon letting the water against them. The lengths entirely constructed on these rules were insignificant, but about five miles of old bank had been faced with puddle laid on earth rammed moist.

A brief comparative sketch of the Grand Junction Canal between Brentford on the Thames and Braunston, and of the Madras Irrigation and Canal Company's Canal between Soonkésala and Cuddapah, was then given; and it was stated that the former was commenced about 1795, and was finished in 1805, making, with the Paddington branch, a total length of 102½ miles in ten years, at a cost which ultimately reached about two millions. The Soonkésala Canal, 190 miles long, was commenced in October, 1861, and was all brought to completion, as required by the Company's engagement with the Government, in June, 1871, or about ten years, at a cost which, when it included wharves and floating stock, would reach about 1¾ million. It was interesting to compare the sizes of the towns affected by the two canals at the time of their opening. London had then 864,845 inhabitants, Madras had about 700,000. Northampton had 7020, Derby 10,832, Dudley 10,107, Walsall 10,400, and Birmingham 73,670. On the other hand, Kurnool had about 12,000, Cuddapah 25,000, and Nundial probably 7000 or 8000. Again, the producing and manufacturing powers of the two districts were strikingly similar, though in contrast. The Grand Junction Canal promoted the production of coal, iron, and lime from below the earth's surface, and the industrious manufacture of exotics by machinery. The Soonkésala Canal could not but promote the production of material for food, clothing, and luxury upon the earth's surface, and the manufacture of food, cloths, colours, paper, &c., for which the Madras Presidency had formerly been celebrated over the whole of Europe and Asia.

ZOOLOGICAL SOCIETY OF LONDON.

At the meeting held on February 20—Professor Flower, F.R.S., V.P., in the chair—the secretary read a report on the additions that had been made to the society's menagerie during the month of January, 1872, and called particular attention to a young king penguin (*apterodytes pennanti*), presented by Mr. F. P. Cobb, of Port Stanley, Falkland Islands, and to a collection of African land tortoises, transmitted by Dr. Grey of Cradock, Cape Colony. The secretary also called attention to the female Sumatran rhinoceros (*rhinoceros sumatrensis*) just added to the society's menagerie. A paper was read by Mr. J. W. Clark, F.Z.S., on the visceral anatomy of the hippopotamus, as observed in the young specimen of this animal which had died in the society's gardens on the 10th January, 1872. After giving an account of the morbid appearances noticed, Mr. Clark described in detail the stomach of this specimen, which appeared to differ in some points from those examined by previous authorities. A communication was read from Dr. J. S. Bowerbank, F.R.S., containing the second part of his "Contributions to a General History of the Spongiadæ," in which was contained a full account of two species of the genus *Geodia*. A paper by the Rev. O. P. Cambridge was read on the spiders of Palestine and Syria, in which was given a general list of the araneidea of those countries, together with descriptions of numerous new species, and the characters of two new genera. A communication was read from Dr. John Anderson, F.Z.S., containing descriptions of some Persian, Himalayan, and other reptiles, either new or little known to science. A second paper by Dr. Anderson contained some further remarks on the external characters of the new Burmese macaque, which he had recently described under the name *Macacus brunneus*. A communication was read from Count Thomaso Salvadori, C.M.Z.S., containing a note on a specimen of Lidths' jay (*Garrulus lidthii*), in the collection of the King of Italy, which had been originally received alive from Japan. Mr. D. G. Elliot, F.Z.S., read a note on a cat described by Dr. Gray in the Proceedings of the Zoological Society for 1867 as *Felis pardinoides* from India, which Mr. Elliot considered to be identical with *Felis Geoffroyii* of South America.

At the meeting held on March 5—John Gould, Esq., F.R.S., V.P., in the chair—Mr. Howard Saunders, F.Z.S., exhibited and made remarks on specimens of *Falco barbarus* and *Cypselus pallidus*, obtained in Southern Spain, being the first recorded occurrences of these species on the continent of Europe. A letter was read from Mr. Walter J. Scott, C.M.Z.S., of Queensland, giving some further information respecting the supposed existence of an undescribed large carnivorous animal in that colony. This letter was accompanied by drawings of the impression of the foot of the animal. Mr. A. H. Garrod, F.Z.S., read some notes taken on the dissection of an ostrich recently living in the society's menagerie. The examination of this bird proved that its death was due to copper poisoning: a number of copper coins and pieces of coin in a much worn state having been found in its stomach. Mr. E. W. H. Holdsworth, F.Z.S., read a paper containing a catalogue of the birds found in Ceylon, with remarks on their localities and geographical distribution, and gave a description of two new species, which were proposed to be called *Zosterops ceylonensis* and *Arrenga blighi*. The total number of Ceylonese birds included in Mr. Holdsworth's list was 323, of which 36 were stated to be peculiar to the island. A communication was read from Dr. Hermann Burmeister, F.M.Z.S., containing a list of the species of the Lamellirostral birds of the Argentine Republic, with remarks on their habits and times of occurrence. A communication was read from Dr. W. Peters, M.F.Z.S., containing a list of a collection of small mammalia recently made by Mr. J. J. Monteiro in Angola. Dr. J. E. Gray, F.Z.S., communicated some notes on a new species of tapir (*Tapirus leucogenys*) from the snowy regions of the Cordilleras of Ecuador recently obtained by Mr. Buckley, to which were added some observations on the young spotted tapirs of Tropical America.

THE ROYAL INSTITUTION.

At Professor Tyndall's fifth lecture on "Ice, Water, Vapour, and Air," the Prince Imperial of France was present, and there was a very large attendance of men of science, ladies, and children.

The Professor, in speaking of the river-like motions of the glaciers, said that not only does the glacier slide over its bed, but the upper layers of ice glide over the under ones, and the centre slides past the sides. He also spoke much about the nature of the great crevasses in the ice, and said that in walking over a glacier explosions are often heard, sometimes as if directly under the feet of the listener, yet, on looking round, nothing is to be seen. Sometimes several of these are heard in quick succession, as if the ice were breaking up all round, still nothing is visible to account for the noise. After perhaps an hour's strict search, the observer may discover the cause of the noises, which severally announce the birth of a crevasse. Air bubbles may be noticed rising through a pool of water in the ice, and the bottom of the pool will be found to be crossed by a narrow crack from which the air-bubbles rise. Right and left from this pool

the young fissure may be traced through long distances. It is sometimes almost too feeble to be seen, and at no place is it wide enough to admit a thick knife-blade. It is difficult to believe that the formidable fissures, the great and gaping chasms in glaciers, begin in this way; and it teaches in an impressive manner that appearances suggestive of very violent action may really be produced by processes so slow as to require refined observations to detect them. In the production of natural phenomena, two things always come into play, namely, the *intensity* of the acting force, and the *time* during which it acts. Make the intensity great and the time small, and there is a sudden convulsion; but precisely the same apparent effect may be produced by making the intensity small and the time great. This truth is strikingly illustrated by the Alpine ice-falls and crevasses; and many geological phenomena, which at first sight suggest violent convulsion, may be really produced in the self-same almost imperceptible way. The lecturer then explained how and why the crevasses at different parts of the glacier run for the most part in particular directions. In speaking of the formation of icebergs, he said that in high latitudes great glaciers sometimes end in the sea. As the great river of ice flows into the water the water tries to float it, and by its upward pressure sometimes breaks off great masses of ice of irregular shape, which float out to sea as icebergs. In other places the water sometimes melts the under surface of the ice, and masses then break off into the sea, because of want of support from below. Some of the greater icebergs are not uncommonly 750 feet high, but the greater portion of them is below water, so that the visible portion may be but 150 or 200 feet high.

VICTORIA (PHILOSOPHICAL) INSTITUTE.

A MEETING of this Institute took place in February. The election of the following nine members having been announced, viz.—Messrs. J. Matthews, W. Newton, T. Seaber, Wilberforce Baynes, O. Edwards, J. Falshaw, Dr. Shann, and the Revs. Algernon Grenfell, M.A., and J. R. Wood, M.A.—the Rev. Dr. Robbins read a paper on "Fatalism." Having glanced at the history of Fatalism from the early ages down to the present time, and its existence in various forms of religious belief, he proceeded to show that, under the Christian dispensation, where the existence of a Creator exercising an over-ruling providence was acknowledged, Fatalism was alike contrary to sound reason and common sense. The paper concluded with various proofs of this; and a discussion ensued, in which the chairman, Dr. Haughton, Mr. Kazi Shehbudden, Rev. T. Gorman, G. Henslow, and others took part.

It was announced that on the 4th proximo a paper would be read on "Prehistoric Monotheism," being a reply to some of the theories advanced in Sir John Lubbock's last work which had not been dealt with in a former paper.

At the meeting of this Institute on 4th March—Mr. C. Brooke, F.R.S., in the chair—the election of the following members was announced:—Professor Macdonald, Edin., Mr. John Eliot Howard, and the Revs. G. S. Rowe, W. Brodie, and C. A. Bury; also the presentation of the Transactions of the Royal and other Societies. A paper was then read on "Prehistoric Monotheism, considered in relation to Man as an Aboriginal Savage," being a reply to certain statements made by Sir John Lubbock in his work on Primitive Man. The paper combated the statements made by that writer, that man in his original state was a savage and without religious knowledge, and disproved it from the results of investigations into the present condition of savages, from the earliest authentic records to be found in various countries, and from the writings of Aristotle, Herodotus, and others. A discussion ensued, in which the following, amongst others, joined:—Dr. Haughton, Dr. Fraser, Mr. Prichard, who stated that so far as his inquiries had extended they confirm the view taken in the paper, and the Rev. G. Percy Badger, who gave similar testimony, and in alluding to an apology made by the author of the paper for not quoting Scripture as an authority, stated that was perhaps judicious, as it enabled him to refute Sir John Lubbock's statement on his own ground, though it seemed strange that the latter should prefer the authority of such as Herodotus—whose writings betrayed ignorance on several points, for instance, where he refuses to believe in snow existing in a land so hot that the inhabitants were black—to the writings of Moses, which, as writings even, were of a much higher order.

Before the meeting adjourned the chairman read a letter from Sir John Lubbock, acknowledging the receipt of a copy of the paper, and an invitation to be present, and regretting that other engagements prevented his accepting it. It was then announced that on the 18th of March Dr. Bateman would read a paper on "Darwinism, tested by Recent Researches in Language."

THE SOCIETY OF TELEGRAPH ENGINEERS recently held its inaugural meeting in the hall of the Institute of Civil Engineers, London; Mr. C. W. Siemens, C.E., F.R.S., presiding.

(*Reviews of Books, continued from page 56.*)

Spiritualism Answered by Science. By EDWARD W. COX, S.L., F.R.G.S.* London: Longman and Co., 1871.

THOSE who take an interest in Spiritualism—we confess we do not—should read this book, for it is a very able exposition of the true cause of its so-called "manifestations," which Mr. Serjeant Cox asserts is the newly-discovered Psychic Force of Mr. Crookes, described in the present work as a force proceeding from, or directly associated with, the human organisation, which, in certain persons and under certain conditions, can cause motion in heavy bodies, and produce audible and palpable sounds in such bodies, without muscular contact or any material connection between any person present and the heavy body so moved or on which the sounds are produced.

The Psychic force is thus described:—

For the reasons presently to be specified, we conclude that this Force is generated in certain persons of peculiar nervous organisation in sufficient power to operate beyond bodily contact. To these persons the spiritualists have given the name of "mediums," on the assumption that they are the means of communication between disembodied spirits and the living; but they who, with myself, dispute the theory of Spiritualism, have given to those persons the more appropriate name of *Psychics*.

There can be little doubt that the Force is possessed by every human being—that it is a necessary condition of the living nerve, if, indeed, it be not the vital force itself; but that it is possessed by Psychics in extraordinary degree. In ordinary persons it ceases to operate at or near the extremities of the nerves; in Psychics it flows beyond them in waves of varying volume and power. Mr. Crookes, indeed, has recently constructed an instrument of extreme delicacy, which seems to indicate the existence of the Psychic Force more or less in every person with whom he has made trial of it.

The existence of such a Force is asserted by Dr. Richardson, in a recent article in the *Popular Science Review*, in which he contends that there is a nerve fluid (or ether), with which the nerves are enveloped, and by whose help it is that the motion of their molecules communicates sensations and transmits the commands of the will. This nerve ether is, he thinks, no other than the vital force. It extends with all of us somewhat beyond the extremities of the nerve structure, and even beyond the surface of the body, encompassing us wholly with an envelope of nerve atmosphere, which varies in its depth and intensity in various persons. This, he contends, will solve many difficult problems in Physiology, and throw a new light on many obscurities in Psychology and Mental Philosophy.

If Dr. Richardson be confirmed in this discovery, there can be little doubt that the Psychic Force is that nerve ether or nerve atmosphere.

But, say the Spiritualists, your Psychic Force is directed by some intelligence. How is *that* to be accounted for? Whence and what is that intelligence? Unless you can show that it proceeds from the Psychic, or some person present, you *must* conclude that it is the product of some other being, and as no other being is visibly present, that being must be a spirit.

To this argument of the Spiritualists, urged in a tone of triumph, the advocates of a Psychic Force have an answer, which appears to be complete.

We contend that the intelligence that directs the Psychic Force is the intelligence of the Psychic, and no other. The reasons for such a conclusion will be set forth presently, and will be admitted by the impartial to be overwhelming. All the conditions requisite to the production and exercise of the Force are consistent with its origin in and direction by the Psychic, and inconsistent with any conceivable action of the disembodied spirits of the dead.

But for the manner in which the force may be governed I must turn to Dr. Carpenter; as for its source, I have referred to the authority of Dr. Richardson.

The explanation will be found in Dr. Carpenter's theory of "unconscious cerebration," or, in less learned language, the capacity of the brain, under certain conditions, to work, not only without the will, but without the consciousness, of the individual. A familiar instance of this is seen in the case of a person stunned. He will walk, talk, return to his home, undress, go to bed, although consciousness is annihilated, and when he "recovers his senses," as it is called, he has no memory of anything, not even of time, from the moment when the blow was received to the moment of consciousness revived. Another instance is the frequent one of somnambulism, natural and artificial, in both of which states the brain acts perfectly and often more powerfully than in the normal state, while consciousness is suspended. Numerous instances are collected by Dr. Carpenter, who attributes to this curious condition most of the phenomena of mesmerism, electro-biology, and other hitherto mysterious mental states which scientific men, unable to explain, have contented themselves with denying or ignoring, and unreflecting persons have attributed to supernatural influences, as the solution nearest at hand. But if this be the true cause, nothing is more simple and obvious than the application of it to the facts that have so long perplexed physiologists and mental philosophers, and for accepting which as *facts* (though they could not explain them) so many honest observers have been called dupes or knaves.

This is probably the intelligence that directs the Psychic Force. It is the brain of the Psychic in that condition of "unconscious cerebration" of which Dr. Carpenter has demonstrated the existence, and which he has dared to maintain in defiance of the accusations of being gullible made by his scientific brethren, always jealous of those who claim the honour of a new discovery.

The Scientific theory, then, which I venture to oppose to the Spiritualist theory of phenomena, whose existence is demonstrated by evidence as conclusive as any that establishes the other facts of Science, is that the Force whose operations are seen in the motion of heavy bodies when untouched and heard in the audible and palpable sounds that come from them, is the force which Dr. Richardson contends to be always existing in the nerve system, and that the intelligence which as certainly often directs that Force is the "Unconscious Cerebration" of Dr. Carpenter.

The learned serjeant has, without doubt, made out a very *good prima facie* case for Crookes' Force *v.* Spiritualism, more than this we do not feel justified in asserting.

Description of an Electrical Telegraph.

By Sir Francis Ronalds, F.R.S. Second Edition. Williams and Norgate, 14, Henrietta Street, Covent Garden, London; and 20, South Frederick Street, Edinburgh.

This second edition of Sir Francis Ronalds' little book is published as a contribution to the History of the Electric Telegraph. Everyone who has materially aided the practical development of that wonderful appliance of modern civilisation, the Electric Telegraph, should have his due share of merit held in remembrance; hence we deem this book well worthy of attentive perusal by every lover of science and civilisation, and, as matter of history and scientific notanda, the facts it relates are by no means unimportant.

Sir Francis says that when he first published this description of an electric telegraph, in 1823, the deficient insulation of *high* static charges of the wires employed in several former attempts at transmitting intelligence electrically, rendered them practically unavailing; and Static Electricity was hence believed, by many, to be an unfit agent.

Not participating in this opinion, and recognising the superiority of Static over Dynamic or Voltaic Electricity, in some important respects, I was led, although not then aware of the well known defalcation in Dynamic Electricity which Professors Weber, Steinheil, and others have indicated, to the invention of apparatus which was capable of maintaining the very *low* static charge required for my principal purpose with a tenacity *approaching* to that of the "perpetual Electrophorus"; and of an arrangement by which the renewal of a sufficient charge was always, quasi, contemporaneous with the partial expenditure due to the discharges required for my signals, and to a very small leakage which still occurred.

The result was a really effective instrument (though on a comparatively limited scale). It has been called the "*Type of all Dial-Telegraphs*," and I have lived to see many of the predictions and opinions contained in my little work of 1823 (extravagant as they seemed at that time), fulfilled and confirmed in a striking manner.

The employment of Electro-Magnetism, discovered by Dr. Œrsted, in 1821, has very greatly facilitated telegraphic operations, and although it does not at present embrace some advantages derivable from the use of Static Electricity, innumerable subsequent inventions and improvements have brought the science of Electro-Magnetic Telegraphy to its present wonderfully advanced state.

The following is a contribution to the History of the Electric Telegraph well worthy of attention:—

Dr. Watson and his friends, Lord C. Cavendish, Mr. Martin Foulks, Dr. Bevis, Mr. Graham, Dr. Birch, Mr. P. Duval, Mr. Trembly, Mr. Elliott, Mr. Robins, Mr. Short, and some other gentlemen, so long ago as the year 1748, proved, that electrical shocks might be conducted through long circuits with *unmeasurable* velocity. These indefatigable and ingenious experimentalists founded the present commonly received axiom amongst electricians, that no perceptible space of time is required to transmit electric signs through conductors of *any* extent; and Mr. Cavallo, in his "Complete Treatise on Electricity," has suggested a method of conveying intelligence, by passing *given numbers of sparks* through an *insulated* wire in given spaces of time. Some German and American savans first projected galvanic or voltaic telegraphs, by the decomposition of water, &c. But the other form of the fluid appeared to me to afford the most accurate and practicable means, of conveying intelligence; and, in the summer of 1816, I *amused* myself by wasting, I fear, a great deal of time, and no small expenditure, in trying to prove, by experiments on a much more extensive scale than had hitherto been adopted, the validity of a project of this kind. I believe I succeeded to the entire satisfaction of several very eminent scientific friends; and I am sure that *they* will at least acquit me of wishing to claim the smallest share of originality which does not belong to them. The *result seemed* to be, that that most extraordinary fluid or agency, electricity, may actually be employed for a more practically useful purpose than the gratification of the philosopher's inquisitive research, the schoolboy's idle amusement, or the physician's *tool*.

The work contains a description of the experimental telegraphs the author erected at Hammersmith, illustrated with plates; as, however, the book is one of only twenty-five pages, it would be unfair to quote further. We therefore advise those of our readers who take an interest in this question to consult its pages for themselves.

Agriculturists their own Superphosphate Makers.

— With illustrations. By Alfred G. Lock, manufacturing chemist. Second Edition. London: E. & F. N. Spon, 48, Charing Cross. 1872.

The following quotations from this little work will inform our readers as to the nature of its character and contents:—

In the course of the past season, whilst calling the attention of farmers to the advantages to be obtained by making their own article, I have been constantly met with the pointed observation, "We would gladly do so; but we don't know how to set about it." Another reason that has operated very much against it is the idea which is prevalent to a very great extent, that a heavy outlay is required for machinery, leaden tanks, and utensils. Now, such is really not the case; the cost of the whole plant for making superphosphate, in tanks, sufficient for the largest-sized farm, would not exceed seven pounds—an amount that would be saved in the first year, even on a small farm. But the plan I advocate, the making of it out of doors, positively requires no plant, no utensils, no implements whatever, excepting a large-sized water-pot, which is always useful in the garden. I have been advised, by several gentlemen who take a great interest in agricultural improvements, to publish an account of how it may be done, and it is with this view that I have been induced to write the following description of the required process, in which I have endeavoured to give as clear and succinct an explanation as possible, without any of the pretensions of a practised author.

It is a fact well known to all those who are in the habit of analysing the ordinary manures offered for sale in the markets, that adulteration is carried on to a very great extent. And it must necessarily be the case, since there is very little check on the dishonesty of any unscrupulous individuals who may choose to become manure manufacturers.

True, by analysing the manures, you can ascertain their contents and marketable value; yet how few are the agriculturists who are able to test them; and even of those who can how few have the time or inclination.

I do not make any assertions against professional manure manufacturers; indeed there are many respectable firms amongst them of known probity and intelligence.

After other prefatory remarks the author proceeds to describe some simple methods and apparatus to be used by farmers for making their own superphosphate, and states that by these described methods not only *is* an article obtained of which you know the ingredients, but at *an actual saving of ten shillings per acre*, as the following calculation will show. It has been proved by many agriculturists, some of whom have made their own superphosphate for years, and a few of whose testimonials (from among many) are inserted at the end of the work.

By experiments which have been made by several agriculturists it has been proved that the application of one sack of dissolved bones to an acre of land, produces a result equal to four cwt. of the best procurable superphosphate.

Now, we will take half-inch bones at 20s. per quarter, yet they can be purchased early in the season as low as 18s. and 18s. 6d., and the best oil of vitriol at 1d. per lb.—the price at which I sell it at the manufactory—and the best superphosphate of lime at £6 5s. per ton (and really serviceable cannot be purchased under); then we have this result:—

1 Sack of Bones at 20s. per quarter	£0 10 0
60 lb. oil of Vitriol at 1d. per lb.	0 5 0
	£0 15 0
4 cwt. Superphosphate at £6 5s. per ton	£1 5 0
Saving effected on one acre	£0 10 0

It would be well if every farmer always kept a few carboys of vitriol by him, so that when horses or cattle die on the farm through disease, accident, or age they might be dissolved and turned into useful manures, instead of as now being buried or given as food to the pigs.

To do this, take the skin from the animal, and sprinkle it well with salt on the fleshy side, to preserve it; then roll it up until an opportunity occurs of selling it to the tanner. Cut up the carcase, and boil it for twenty-four hours in a copper of water, by which time the bones can easily be taken out. During the boiling a quantity of fat will float on the top, which should be carefully skimmed off and preserved, as it is very superior to any other grease for cart-axles or machinery. The liquor is excellent for wetting bones—better than simple water—or it could be emptied into the manure tank. The bones should be broken as small as possible, and, with the flesh, put into the tank. Some water must be added, and, in the next place, some oil of vitriol, the whole to be covered with some ashes. Let the compound remain for several days, at the end of which time it could be dug out, mixed with the ashes, and used as superphosphate.

A friend of mine, in the present year, made some manure in this way, at a cost of about £4 15s. per ton; of which he used an equal quantity per acre on the same day and on the same soil by the side of some blood manure at £8 per ton, and found his own to be far superior. A horse will yield from 50 to 80 lbs. of *dry* bones, according to size.

The work seems well worthy of the attention of all agriculturalists.

Psychic Force and Modern Spiritualism:

A Reply to the *Quarterly Review* and other Critics. By William Crookes, F.R.S., &c. London: Longmans, Green, and Co. 1872.

After the space we have devoted to the Psychic Force question in our review of Mr. Serjeant Cox's pamphlet, we need not do more than place, as we have done, its title-page before our readers.

The Inventors' Patent-right Association, Limited.—This now well-known and ably conducted Association, the prospectus of which appears in the advertising columns, is, as may be seen from the list of recorded specifications, transacting a large patent business. Its organisation for obtaining patents combines so great economy in the charges with sterling efficiency, and its arrangements are so complete for unravelling disputed questions of patent-right, that it is gratifying to find former predictions as to its success fully borne out by the results. Members of the Inventors' Institute, to whom, moreover, it affords special advantages for obtaining and maintaining patent-rights, largely avail themselves of the services of the Association.

(Continued from page 50.)

On 9th Feb.—415. J. Kitch. Manufacturing groats, and in apparatus therefor.—416. A. Creswell. Straining or filtering liquids.—417. H. J. Jupp. Apparatus for breaking or reducing bituminous rocks, bones, and other substances.—418. C. Hodgson. Apparatus or appliances to be used in connection with wire tramways. —419. J. H. Johnson. Steam generators, and in the mode of applying heat thereto (com.)—420. J. H. Johnson. Refrigerating apparatus (com.)—421. W. R. Lake. Mowing and reaping machines (com.)

On 10th Feb.—422. E. A. Cook and N. M. Henderson. Treating hydrocarbon oils.—423. E. H. C. Monckton. Drying peat so as to render it suitable for fuel, or for conversion into charcoal and other useful products, and in the apparatus for effecting the same —424. J. H. Johnson. Furnaces for the treatment of zinc ores.—425. R. F. Smith. Obtaining yellow and red prussiates.—426. J. H. Johnson. Treatment of zinc ores and other volatile metals, and in apparatus employed therein (com.) — 427. C. Frances. Privies and the ash-pits connected therewith. — 428. H. Bottomley. Means or apparatus employed in doubling worsted or other yarns.—429. W Ireland and J. Ireland. Manufacture of cast or Bessemer steel ingots (com.) (Complete Specification.)—430. J. E. Wood. Railway carriages. — 431. J. Hastie. Ship steering apparatus.—432. W. R. Lake. Gas engines(com.) (Complete Specification.)—433. W. E. Gedge. Improved horizontal tubular boiler(com)—434. B. Dobson, T. H. Rushton, and W. Dobson. Machines for ginning cotton.—435. J. Roboy. A substitute for animal charcoal.—436. A. M. Clark. Propulsion of vessels, and in apparatus for the same(com.)—437. A. M. Clark. Apparatus for propelling vessels (com)

On 12th Feb.—438. J. H. Greener and T. S. Sarney. Fastenings for permanent way.—439. C. Notara. Method for separating various kinds and qualities of grain and seed, and for regulating the feed or supply of grain or seed in connection therewith —440. R. Burn, junior. Apparatus for signalling on railways. 441. A. Barraclough and T. C. Barraclough. Apparatus for damping, stiffening, oiling, and colouring fabrics, and damping, oiling, and colouring fibrous materials, yarns, and paper 442. T J. Smith. Means of and apparatus for dividing the fleece in carding engines (com.)—443. W. R. Lake. Method of uniting and securing beams or pieces of wood or metal in the construction of bridges and for other like purposes (com) - 444. W. R. Lake. Metallic cans and similar vessels, and in locking devices therefor (com).—445. H. Walker. Breech-loading small arms —446 T. M Wilson. Mode of and apparatus for refining or purifying oils.

On 13th Feb.—447. J. A. Hodgson. Apparatus or gear for driving a screw propeller when the engines are broken down at sea.—448. S Fulda. Treating of impure or discoloured waters for the purpose of clarifying the same, and in the employment of the refuse for agricultural purposes.—449. H. Scott. Ventilating sewers and drains.—450. B. Hunt. Postal cards and in covers therefor (com.)—451. A. W. Pocock. Construction of fasteners for window-sashes.—452. J. J. Allingham. Means of and apparatus for moving vessels through the water.—453. P. D. Deans and D. MacNaughton. Production of sulphate of ammonia.—454. F. H. Warlich. Manufacture of artificial fuel, and in apparatus to be used for this purpose.—455. J. D. Nichol and J. Eckersley. Apparatus for drying and pressing or callendering printed paper. -456. W. Richardson Machinery for burring and cleaning or opening wool, cotton, and other fibrous materials.—457. O. C. Setchell Treating or preparing certain waste substances, so as to render them useful as compositions for lighting fires.

On 14th Feb.—458. E. Cottam. Construction of buildings for the safe keeping of deeds and other securities or valuable property.—459. J. Young. Treating hydrocarbons.—460. C. W. E. Marsh. Apparatus for communicating between the passengers and guard or between the guards and drivers of railway trains.—461. E. H. Blundon and S. T. Cleaver. Construction of cocks or taps.—462. G. W. E. Marsh. Meters or apparatus for measuring water or other liquids.—463. C. H. Boeckner and G. Lunge. Boilers for papermakers and others. —464. H. B. Barlow. Preserving animal and vegetable substances (com.)—465. D. Carter. "Dry earth" closets.—466. G. Prints. Machine to stamp needles, called "needles-stamping machine" (com.)—467. Hon. J. Colborne, captain in H.M. 11th Foot. New explanatory method of teaching military drill, and an apparatus therefor.—468. T. Bear. Adaptation of mica or talc to water-gauges to steam and other boilers.—469. T. J. Smith. Apparatus for retarding and stopping railway trains (com.)—470. M. Carr, junior. Dry earth closets. —471. O. Walch. Apparatus to be used in the manufacture of matches.—472. T. Johnson. Valves for sewers or drains, for preventing or arresting the passage of noxious or offensive gases.

On 15th Feb.—473. Sir Charles Wheatstone, Knt., and J. M. A. Stroh. Electro-magnetic telegraphs and apparatus connected therewith, parts of which improvements are applicable to other purposes. (Complete Specification.)—474. J. Hamilton. Sewing machines.—475. R. Edwards and T. Robinson. Construction of furnaces for heating, puddling, or melting iron, steel, or other metals.—476. T. Rowan. Preparing carbonates or oxides of lead and zinc for use as pigments and otherwise.—477. T. J. Smith. Means of and apparatus for communicating between railway carriages, and for ventilating the same (com.)—478. R. Swindels and J. Wormald. Spanners.—479. J. H. Lock. Apparatus or means of indicating the name of the station or the names of the stations to which a railway train is proceeding, and the name of the station at which the train successively stops.—480. C. D. Abel. Moulds and cores, and mould and core linings and facings for metal castings, and in materials employed therefor (com.)—481 W. R. Lake. Harvesting machines (com.) (Complete Specification.)—482. E. T. Truman. Covering wire or other suitable conductors with insulating materials, and in machinery employed in the covering process.—483. W. H. Harfield. Windlasses and chain controllers.—484. F. Hillé. Treatment and utilisation of sewage, and the manufacture of manure therefrom. 485. H Highton. Galvanic batteries. 486. E. Ward. Manufacture of vesuvians, fuzees, or other matches used for lighting pipes, cigars, and other similar purposes. —487. W. N. and T. Nuttall. Looms for weaving.—488. J. J. P. V. Touche. Mode of preparing roadways. —489. A. V. Newton. Sewing machines (com.)

On 16th Feb.—490. R. Graham and M. D. Wood. Apparatus used in the production of artificial teeth, known as dental articulators 491 H. Gardner. Treating certain fibres, and more especially the fibre derived from the Baobab tree or adansonia digitata, to render them fit for spinning and other useful purposes, and in machinery therefor.—492. W. E. Gedge. Compound to be used for cleaning metals (com.) —493. E. Tombs. Manufacture of neckties and other similar articles of wearing apparel —494. W. Simons and A. Brown. Steam hopper dredgers.- 495. E. Edwards. Improved dust shield for railway carriages, and mode of hanging such shield. (Complete Specification.) —496. E. H. Bayley. Fire-escapes.—497 G Williamson and W. H. Williamson. Construction of the travelling wheels of traction engines, road rollers, steam carriages, or other traction vehicles, and in the construction of wheels, pulleys, or drums for transmitting power in connection with such vehicles, or where power is required to be transmitted by means of cords, ropes, or belts.—498. G. Hasey and J. Young. Fire escapes, drop-curtains of theatres, and other buildings, for the purpose of preserving human life and property from the effects of fire.—499. H. L. D. Marsden. Lithography, zincography, engraving, and such like processes of producing prints or impressions.—500. W. R. Lake. Manufacture of boots and shoes, and in machinery therefor (com.) (Complete Specification.)—501. W. R. Lake. Shuttles for weaving narrow fabrics (com.) (Complete Specification.)—502. A. Bell and J. Walker. Appliances to distilling, brewing, and other chemical processes or purposes.—503. W. R. Lake. Improved operating mechanism for washing machines and churns (com.)—504. R. M. Taylor. Means or apparatus for the manufacture from pulverised or powdered clay of castor runners, door knobs, and other articles requiring a hole through or a recess in them.—505. W. Musgrave and R. C. Musgrave. Apparatus for looping or producing eyes on wire.—506 A. V. Newton. Lever punches, applicable also to die presses, stamps, and shears (com.)—507. T. Sturgeon. Machinery and apparatus for dressing and furrowing millstones, and for dressing other stones.

On 17th Feb.—508. J. Hargreaves and T. Robinson. Production of chlorine and hydrochloric acid, and in apparatus employed therein.—509. J. Hargreaves and T. Robinson. Manufacture of alkalies, and in apparatus employed therein. —510. A. Browne. Method of and apparatus for treating and preparing the stalks of a certain vegetable fibrous substance, known and distinguished in France as "La Filasse d'Alfa (Sparto)," to adapt it for manufacturing purposes (com.)—511. J. C. Mewburn. Hackling machines (com.)—512. B. Hunt. Manufacture of pottery ware, and in the apparatus to be employed therein (com.)—513. J. Anderson. Reducing oxides, and in obtaining iron, sodium, potassium, phosphorus, chlorine, or their compounds, and in apparatus therefor.—514. T. Henderson. Screw steamers.—515. G. A. Williams. Manufacture of outside sun-blinds. —516. H. Defries. Railway carriage, street, and other lamps.—517. T. Scruton. Coffins. —518. W. C. McEntee. Horse-shoes and shoes for other animals.—519. W. F. Heshuyson. Automatic water or other fluid regulator. —520. J. Rice. Construction of fire-grates, stoves, and furnaces. -521. W. R. Lake. Breech-loading firearms (com.)—522. F. Hinton. Breast collars for horses or other draught animals.—523. A. Tylor and G. Fleury. Apparatus for regulating, controlling, and arresting the flow of liquids and fluids and preventing waste.—524. A. M. Clark. Time-signalling apparatus for railways (com.)—525. W. R. Lake. Cases or vessels for packing caustic alkalies, acids, salts, and other like materials, and in apparatus for forming the same (com.)

On 19th Feb. -526. J. H. Johnson. Liqueurs or cordials (com)—527. W. R. Lake. Furnaces for steam boilers (com.) -528. J. W. Gregg. Paraffin and other lanterns and lamps.—529. B. Hunt. Leather or other stiffenings for boots and shoes (com.) 530. D. G Low. Sail hank. (Complete Specification.)—531. S. Nuttall. Shuttles for looms (com.)—532. N. Beamish. Steam and other motive-power engines, and in the arrangement of same, which improvements are more especially adapted to marine engines. -533. F F. Taylor and H. W. Larkin. Improved safety car coupling. (Complete Specification.) -534. W. Campion Machinery and apparatus for linking, joining, turning off, clearing, and seaming or stitching looped or knitted and other fabrics. (Complete Specification.) 535. W. Gilkerson. Measure for liquids.-536. W. R. Lake. Machines for cutting textile fabrics, leather, paper, and other like materials (com) (Complete Specification.)—537. G. Haseltine. Rakes and rake-operating mechanism for harvesting machines (com.) (Complete Specification.)—538. W. R. Lake. Lawn mowing machine (com.) (Complete Specification.) - 539. E. Chadwick. Construction of roads and ways, and in the mode or means of draining such roads or ways and the lands and houses adjacent thereto.—540. D. Stevens. Improvements in or connected with apparatus or machines for grinding or reducing ores and mineral substances.

On 20th Feb —541. E. B Keeling. Dish or vessel for containing and serving preserved meats and other foods.—542. P. H. H. Nickson. Improved safes. 543. F. W. Hudson. Stopping and releasing spring and other roller blinds.—544. H. D. P. Cunningham. Improvements in fork guards. — 545. W. E. Newton. Lithographic printing machinery (com.) — 546. J. A. Jaques and T. Oakley. Machines for grinding and surfacing articles made of iron or steel. -547. S. W. Rich. Improved process for treating aluminous schist or shale.—548 A. Annandale. Machinery or appliances for the manufacture, renewal, and repair of knotter plates used in paper-mills.—549. J. Fletcher. Improved heat-resisting packing for the stuffing boxes of piston-rods, pump-rods, valve-spindles, and rams. — 550. C. W. Collins. Apparatus for communicating between the passengers, guards, and engine-drivers on railway trains.- 551. H. Gallagher. An improvement in the manufacture of hat bodies for silk and other covered hats.

On 21st Feb.—552. R. Hattersley. Mechanism or apparatus for distributing printers' type ready for hand or machine composing.—553. C. E. Zundaes. Self-acting pneumatic fire

alarm.—554. J. Henderson. Converting cast iron into steel and wrought iron, and purifying cast iron for foundry and other purposes.—555. W. H. Cory and E. Cory. Manufacture of artificial fuel blocks, and in machinery for compressing the same, which machinery is also applicable for compressing other materials into blocks.—556. W. Dingley. Improvement or improvements in the manufacture of iron and steel. — 557. B. Craig. Apparatus or machinery for signalling and communicating between passengers, guards, and drivers of railway trains.—558. A. Laurie. Skylights.—559. W. J. Murphy. Improved system or method of "rifling" applicable to fire-arms and ordnance.—560. J. L. Baker and T. N. Cox. Construction of single and double furrow ploughs.—561. F. A. Gatty. Printing and dyeing cotton fabrics.—562. G. Speight. Manufacture of collars, cuffs, wristbands, shirt-fronts, and other similar articles, and in apparatus for the purpose.—563. W. C. Church. Steam-engines, parts of which improvements are applicable to hydraulic rams and pumps.—564. C. Macpherson. Ventilating sewers and drains.—565. C. Lenny. Carriage heads, and in apparatus for raising and lowering or assisting to raise and lower them.

On 22nd Feb.—566. W. H. Le Mesurier. Mode of roofing buildings.—567. J. Rust. Composition specially applicable for use for sanitary, pictorial, decorative, and building purposes.—568. F. W. Lawson and E. G. Fitton. Apparatus for preventing accidents with the bolts used for driving machinery. — 569. W. E. Rendle. Greenhouses and other glazed structures for horticultural purposes, and in apparatus for supplying water or liquid thereto or over the land. — 570. J. Cameron. Plate-bending machines.—571. E. Konigs. Obtaining sulphate of soda or of potash and hydrochloric acid or chlorine. -572. B. Hunt. Manufacture of leather, and in the processes and compositions to be employed therein (com.)—573. R. Eldon. Conversion of cast iron into steel or wrought iron, and in the apparatus employed therein. — 574. V. A. Roquencourt. Apparatus for manufacturing artificial flowers. —575. W. C. Sillar and R. G. Sillar. Treating and deodorising human excreta, and thereby facilitating the disposal and utilisation thereof. 576. W. E. Newton. Construction of hoisting apparatus and safety hatches to be used therewith (com.)—577. W. Goulton and C. Davis. Construction of draining ploughs. 578. J. H Johnson. Stamped lead pencils, and in apparatus for stamping the same and other varnished articles (com.) — 579. W. R. Lake. Apparatus for cutting, shaping, and polishing or finishing marble and other stone (com)

On 23rd Feb.—580. J. G. Weir. Sewing machines, and in sewing machine needles. —581. C. H. Bayley and F. L. Stott. Winding cotton and other fibrous yarn or thread.—582. S. Whitham. Manufacture of pile for bloom for weldless tires made either of iron or steel.—583. S Yeadon the elder. "Healds" or "heddles" for weaving purposes, in the parts connected therewith, and in the means or apparatus employed in the manufacture of the parts of such "healds" or "heddles." — 584. W. Rowan. Preparation of flax, hemp, and other fibrous materials, also the tow thereof for spinning purposes.—585. B. J. B. Mills. Railway rails or bars.—586. A. Moore and A. C. Moore. Roll caps for sheet-metal roofing. —587. W. E. Gedge. Improvements in rolling mills or machines for manufacturing bar iron (com)—588. R. Porter and T. Lane. Apparatus used in the manufacture of gas, parts of which improvements are also applicable to other purposes.—589. J. Swindells. Self-acting equilibrium tilt for tilting barrels. — 590. E. T. Hughes. Machines for sewing boots and shoes. 591. J. West. Looms for weaving.—592. O. G. Bolitho. Apparatus for applying railway brakes, also for effecting communication between guards, passengers, and engine-drivers. 593. J. Quick the elder, J. Quick the younger, and A. Cooper. Signal lanterns or lamps.

On 24th Feb.—594. A. G. Wallis and W. Bradshaw. Manufacture of cocoa-fibre mats.—595. G. Westinghouse, junior. Pneumatic apparatus for working brakes and communicating signals in railway trains.—596. H. R. Minns. Metal doors. — 597. T. Pepper. Washing machine. 598. F. Ayrton and S. S. Brown. Looms for weaving.

On 26th Feb.—599. C. Weekes. Carriages for common roads.—600. J. W. Wood. Apparatus or appliances for stopping holes in ships' boilers and other vessels or objects.—601. E. S Copeman. Apparatus for communicating between the several parts of railway trains.—602. W. Weldon. Treating and applying dilute chlorine. —603. R. King. Portable closet or privy receptacle for sanitary purposes. — 604. A. M. Haggart. Envelopes.—605. C. W. Granville. Process and machine for making paper-pulp from wood. (Complete Specification.)—606. S. T. Vanel. New composition and process for waterproofing all sorts of tissues, linen, paper, and other materials.—607. T. Blundell, G. T. Blundell, and J. W. Blundell. Water-closets, and in the mode and means of regulating the supply of water to their pans.—608. A. M. Clark. Knitting machines (com.)—609. A. M. Clark. Machinery for finishing horse-shoe nails (com.)—610. J. H. Johnson. Constructing asphalted roads, and in apparatus employed therein (com.)—611. R. J. Ellis. Tubular fire-bar and connecting bearer for furnaces of steam and other boilers.—612. W. H. Chase. Lever apparatus for moving carriages and trucks on railways. — 613. W. Walker. Packing for stuffing-boxes.—614. O. G. Abbott, School desks which are applicable to other purposes.—615. J. Reilly. Apparatus for signalling on railways and in railway trains, and also other improved arrangements and combinations for the prevention of accidents.

On 28th Feb.—616. V. Bablon. Apparatus for measuring the delivery of gaseous, fluid, or other currents. — 617. J. Young. Treating hydrocarbons. - 618. J. Young. Apparatus for obtaining hydrocarbons from shale, coal, or other similar substances.—619. C. Toft. Improved balance cover for hot-water jugs and other covered vessels of a similar description. — 620. N. Washburn. Cast-metal and steel tired wheels for railway carriages, and the manufacture of such wheels. (Complete Specification.) — 621. J. Thompson. Lids or covers of vegetable dishes and other similar articles.—622. H. W. Hammond. A system of movable velum or shelter (com)—623. W. Roberts. Machine for painting laths for Venetian blinds and other purposes.—624. G. H. Smith. Metallic alloys, and in their application to iron surfaces for preventing the corrosion of the same.—625. F. W. Lawson. Batching jute (com.) (Complete Specification.)—626. W. E. Gedge. Machinery or apparatus for manufacturing manure and the production of ammonia (com.) -627. H. R. Minns. Construction of tramways and railways, and in the wheels of vehicles used thereon.—628. A. H. Brandon. Machine for cutting files (com.) 629. D. Pidgeon and W. Manwaring. Reaping machines.

On 29th Feb —630. W. Hamer. Apparatus employed in the manufacture of salt.—631. C. H. E. Bradauer. Metallic pens. — 632. E. Kenward. Ploughs. — 633. B. J. B. Mills. Dividing and stripping apparatus applicable to carding engines (com.) - 634. J. Wallace. Apparatus for burning gas to produce heat.—635. A. M. Clark. Saws (com.)—636. W. Morgan. Baskets, specially applicable to coaling ships and vessels. - 637. D. Hanna. Sewing machines. — 638. J. Wilson and G. Lendrum. Method or means of finishing woollen cloth. 639. E. T. Hughes. Arrangements for rapidly and effectively destroying snow and ice in the streets, public places, courtyards, and other localities (com.)

On 1st March.—640. J. Grindrod and J. Worthington. Machinery for dressing stone.—641. G. R. Smith. Applying colours or tints to the surfaces of photographs or surfaces (com.)—642. J. W. Perkins. Phosphates of lime or phosphates of alumina. — 643. J. Sunley. Machines or apparatus for cutting the edges of grass lawns, verges, and other places, and for collecting the grass.—644. J. B. Saundres. Electrical instruments for signalling on railways. — 645. W. Blackburn. Standards or supports for seats and desks or tables for school and other purposes. — 646. A. G. Southby. Apparatus for warming and ventilating —647. J. W. Edmunds. Obtaining motive power.—648. G. G. Tandy and J. A. Dryden. Lamps.—649. H. R. Marsden. Stone-breaking machines. —650. J. H. Johnson. Dampers for damping paper or for other purposes (com.)—651. L. Barnett. Reversible and seamless coats.

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SCIENTIFIC REVIEW

RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

AND

Journal of the Inventors' Institute.

[REGISTERED FOR TRANSMISSION ABROAD.] [ALL RIGHTS RESERVED.]

VOL. VII.—No. 5.] MAY 1, 1872. [PRICE 6D.

⁎ *Communications to the Editor to be addressed to him at 21, Cockspur Street.*

CONTENTS.

THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

Chairman of the Council—SIR ANTONIO BRADY.

THE various efforts which have been made, and the numerous influences now at work to injure, if not to destroy, Patent Rights, the inefficiency of the many well intended, but ill considered, schemes of Patent Law Reform which have from time to time been suggested, and the tendency of which has generally been to prejudice the Inventor, without advantage to the Public, together with the proceedings so essentially involving the interests of inventors which have already taken place in Parliament, show the necessity of an immediate and active co-operation on the part of those interested in Inventions and in Patent Property, and that an Association for the Protection and Defence of Patent Rights is urgently needed. This Institute has, therefore, been established for the purpose of uniting and organising the influence of Inventors, Patentees, and others. Its objects are—

1st. To protect Inventors' interests and defend the privilege of obtaining her Majesty's Letters Patent.

2nd. To promote improvements in the Patent Laws.

3rd. To facilitate the diffusion of information with reference to Inventions and other subjects beneficial to Inventors and Patentees.

The qualification for Annual Members of the Institute is a yearly Subscription of One Guinea, and for Life Members a single payment of Ten Guineas.

Persons desirous of becoming members are requested to forward their names and addresses to

R. MARSDEN LATHAM,
Secretary.

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* "(com.)" means "Invention communicated from abroad."

—681. W. E. Carrington. Felt hats.—682. J. W. Melling. Engines actuated by steam or other elastic fluid.

On 6th March.—683. W. Lancaster and J. Bullough. Machinery for sizing and dressing yarns. (Complete Specification).—684. W. Dalgliesh. Manufacture of Scotch bonnets, and in the machinery or apparatus employed therefor.—685. C. D. Abel. Manufacture of Bessemer steel and iron, and in the production of iron castings, and in apparatus therefor (com.)—686. J. G. Frei and G. Kember. Construction of pumps for raising and forcing beer and other liquids.—687. T. Taylor. Turning bowling-green bowls, and in the machinery or apparatus employed therefor.—688. H. Perry. Manufacture of bottles for containing liquids.—689. J. Drevet. Hydraulic beton.—690. C. Sargent and C. Temple. Steering apparatus.—691. W. O. Palmer. Machinery or apparatus for working the brakes of railway and other carriages.—692. W. H. Cope. Machinery for boring, cutting, and working rock and other hard substances, chiefly designed for mining, tunnelling, and other like operations.—693. H. J. Griswold. Knitting machines.

On 7th March.—694. J. C. Lee. Processes for recovering oil and other useful matters from soapsuds or scourings, and from other waste waters resulting from manufacturing processes.—695. S. Elson. Fuel economisers and steam generators.—696. J. Roberts. Construction of tramways, and in apparatus to be used in connection therewith. (Complete Specification.)—697. J. W. Carter. Facilitating linen marking.—698. H. Glover. Local magnetic attraction indicators.—699. J. Arnold. Instrument or appliance for administering balls and other medicines to horses and other animals.—700. B. Smith, J. Stake, R. Tolson, M. Firth, and C. Bradley. Apparatus employed in the combing of wool and other fibres.—701. A. M. Clark. Horse-shoes (com.)—702. A. M. Clark. Covering top rolls of carding, spinning, and twisting machines (com.)—703. G. White. Shuttles for weaving (com.)—704. E. W. Elmslie. Manufacture of hermetically-closed cases and the opening thereof.—705. A. F. Andrews. Process of making malleable cast-iron, and in apparatus therefor.—706. W. R. Lake. Type-setting machine (com.)—707. E. Ozanne. Apparatus for opening and shutting gas-valves, and in lighting and extinguishing gas-lamps.—708. T. H. Blamires, H. Blamires, and H. Marsden. Carding engines.

On 8th March.—709. M. Brierley and F. L. Stott. Manufacture of yarns or threads formed of mixed cotton and animal wool.—710. G. T. Bousfield. Sewing machines (com.) (Complete Specification.)—711. M. A. Wier. Pneumatic apparatus for the transmission and indication of signals.—712. J. Smith. Steam boilers and their appendages.—713. S. Littlejohns. Part of harness called the pad, for instantaneous release of the horse when fallen from accident.—714. C. Avery. Rotary steam engines and pumps.—715. J. Garneri. Production and decomposition of anhydrous chlorides, and apparatus for those purposes.—716. J. Holder. Pavement.—717. W. R. Lake. Cleaning cotton (com.) (Complete Specification.)—718. C. W. Lancaster. Shot, shell, and other similar missiles.—719. J. G. Harrison. Gridiron steps for carriages.—720. F. Trotman, W. Turner, and W. H. Ryves. Closing and opening of necked vessels or bottles.—721. W. Gray. Rotary engines and pumps.—722. W. R. Lake. Governors for steam-engines (com.) (Complete Specification.)

On 9th March.—723. T. D. T. Sparrow and C. G. Spencer. Boomerang and mechanical apparatus for propelling or projecting the same.—724. J. J. Grinlinton. Utilising and giving additional value to the products of the coffee bush (com.)—725. R. Edwards. Portable and self-propelling engines, and in adapting them for the purpose of steam ploughing.—726. T. Brearley. Improved finish of woollen textile fabrics, and means or apparatus for producing the same.—727. J. F. C. Farquhar. Lighthouse and other lamps.—728. T. Perkins, E. Faux, and S. W. Campain. Implements for cultivating land, and for actuating the same by steam-power.—729. J. A. Anderson. Preserving the cargoes of ships, and in the extinction of fire in ships' holds.—730. R. H. Patterson. Purification of coal gas.—731. S. Corbett. Ploughs and cultivators.—732. A. Johnson.

(Continued on page 78.)

THE INVENTORS' PATENTRIGHT ASSOCIATION,

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When an Inventor, after, it may be, years of thought and labour, has brought into practical shape the product of his brain, he is, perhaps, assailed with doubts as to the novelty or commercial utility of his invention, he knows little of the process by which his rights in it are to be secured, and he feels some natural apprehension about confiding to mere agents that which has cost him so much, and which, once revealed, may be so readily appropriated by others.

The Inventor, having legally protected his invention, requires influence, capital, and publicity, in order that he may turn it to profitable account. Before he can secure the aid of capitalists or of public bodies, he must establish to their satisfaction that his invention is novel, practicable, and duly protected by law. Its having passed through the hands of a Patent Agent, whatever his position and repute, is no proof that it fulfils those conditions, for the Agent's business is to pass an invention through the proper legal forms without necessarily paying regard to its novelty or utility.

When an invention, fully protected, has been brought into use, and especially if it be one of great value, it is subject to infringement and evasion. The Inventor, frightened at the anxiety and expense of legal process, too often allows infringement to go on, and suffers himself to be robbed of most valuable property, for want of some organised system of defence, to which he may have recourse. He may, it is true, obtain legal assistance, but he cannot, without difficulty, procure from the skilled and experienced such evidence and advice as are necessary for defending his rights against invasion.

Several leading members of the Inventors' Institute, coming daily in contact with Inventors, whose wants and difficulties are daily pressed on their attention, have formed themselves into an association, entitled "The Inventors' Patentright Association, Limited," in order to supply Inventors with the best and most reliable information and advice—to provide skilled references on questions of science and manufacture—to render legal process for protecting and maintaining patentrights safe, cheap, and ready—and to aid inventors in bringing their Inventions into practical and profitable shape. To carry out these views, the Inventors' Patentright Association have set before themselves the following objects:

Objects of the Association.

To obtain Patents for Inventions in this and other Countries.

To Register Designs.

To Sell, and License Patented Inventions.

To form Public Companies, or otherwise arrange for the Public introduction of Patented Inventions.

To furnish Advice and Professional Assistance in developing inventions.

To collect Evidence, arrange Arbitrations, and otherwise assist Inventors in maintaining their rights.

Directions for the Guidance of Intending Patentees.

The operation of an English patent extends over the whole of the United Kingdom of Great Britain and Ireland, the Channel Islands, and the Isle of Man.

All English Patents are granted for the period of fourteen years, subject to the payment of certain Government stamp duties at the end of the third and seventh years.

In order that an Inventor may be placed in a secure position as to his patentright, and come before the public with any chance of commercial success, it is absolutely necessary that the Invention receive Provisional Protection, which secures it for a period of six months.

In order to obtain Provisional Protection, the Inventor should forward to the Secretary full particulars of the Invention, together with a model or rough pen-and-ink sketch, if the Invention be a mechanical one; also a statement of the features of novelty which the Invention possesses.

With all applications for Provisional Protection, either a Provisional or a Complete Specification must be filed at the Government Office. The usual course is to file a Provisional Specification, in which case drawings are seldom required. The Complete Specification must, however, be filed within six months from the date of Provisional Protection; and, if the Invention be a mechanical one, must be accompanied by drawings fully illustrating and explaining it in all its details.

Generally, the personal attendance of an Inventor in London is unnecessary; the transmission to the Secretary of full particulars of an Invention, together with a model or rough pen-and-ink sketch is, in most cases, sufficient.

The Secretary, whenever he is required to do so, gives a written undertaking to an Inventor not to disclose his Invention without his consent.

Scale of Charges.

	£	s.	d.		£	s.	d.
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OUR COLONIAL SYSTEM AND OUR INVENTORS.

THE British Empire, as the dominions of Her Britannic Majesty are oftentimes termed, is proudly spoken of as one on which the sun never sets, so world-expanding are its bounds. True as this may be, it is also true that as regards solidarity of common government this is the most unique of human institutions—perhaps the finest specimen of that extreme communalistic system of government which so many of our Gallic neighbours lately fought for, yet failed to establish.

The different countries that comprise the great aggregation of states forming this empire are to be found in all parts of the world. Some of them lie near to the frozen regions of the North Pole, others are situate in the tropics, and some in southern temperate climes. Hence we have conditions of existence of the most varied kinds, and as a natural consequence a wide difference of views of what is politically desirable for each community respectively. All, however, hold equally to the notion that they are entitled to all the powers and privileges of self-government. In short, with them "home rule" is the motto; and the only allegiance to the mother country that they are willing to acknowledge is the right to call upon the British Lion to roar out and assault any foreign foes or spoliators.

This state of disunion, however, has not been so much the result of any determination on the part of the colonies to separate themselves from Britain, as it has been the effect of the absurd system, or rather no system, by which the connection of the different parts of the Empire has been attempted to be maintained. Ignoring the genius of the British race, the central Government originally attempted to rule by assuming a position of paternal tyranny, claiming the right to legislate for, to tax, and to govern the colonies, without the action of that representative system which is so dear to every Briton; and History tells us the result in the case of those great colonies of America—to-day the United States—a result that would have been paralleled in Canada had not the warning of that unfortuitous result produced its effect on our statesmen when the Canadian crisis came.

To this policy of paternal tyranny another equally mistaken succeeded, which may be characterised as one of alternate bullying, bungling, and mean submission on the part of the central Government. Whilst a colony was young and weak, there would be much interference; when it began to grow up and show signs of strength, this policy would be changed for submissiveness and deference for even the most capricious of colonial demands.

At last we seem to have arrived at the conclusion that every individual colony, even when it has only a few thousands of inhabitants, shall be made an independent state, with a ministry and parliament of its own; in fact, all we seem to care for is that we shall increase, and retain in our hands, the patronage of appointing governors and such other officials as colonial jealousy may allow us to provide and pay for.

The evils of all this are not a few, and of considerable gravity—conflicting tariffs of Government duties on exports and imports, obstructions to commercial intercourse between the different parts of the Empire, and last but not least, the erection of a multitude of barriers against the entrance of inventive genius into the colonies, as will be readily understood if the exact position of Colonial Patent Law be considered.

Previous to the passing of the Patent Law Amendment Act of 1852, by the payment of an extra sum of about ten pounds the protective power of an English patent could be made to extend to "all Her Majesty's Colonies and Plantations abroad"; but since that date patents for the United Kingdom are restricted in authority to England, Wales, Scotland, Ireland, the "Channel Islands, and Isle of Man," so that whenever it is found necessary or desirable to extend the right of an inventor to any of the colonies, even to a petty West Indian island, a separate patent or special grant must be obtained, at a cost in official fees and professional charges of sums varying in amount from five-and-twenty pounds to nearly one hundred pounds for each colony. If an invention be patented in the whole of the colonies, probably five hundred pounds would not pay the costs, even if the expense be not included of separate specifications and drawings for each colony.

In Canada, moreover, it has seemed good unto the political wisdom of the "Dominion" to place a special barrier in the way of any inventor obtaining a patent who is a British subject, *not a resident of Canada*, or who is a citizen of the United States; and this extraordinary law has been duly allowed by the Government at home

India also requires a separate patent to be taken out in order to protect an invention there; but we do not include that territory in the colonial question, as our possessions there have the nature properly of a distinct empire, which is an appanage of the British Crown, and does not really fall into the position of a constituent part of the *British* Empire.

Nearly all the colonies, amongst other legal requirements, demand that an inventor shall bring his invention first into the particular colony for which he seeks protection, so that there is often a conflict on this point. It seems to us that much, if not all of these colonial difficulties, especially as regards inventors, would soon be removed out of the way, if some sort of a consultative body, representing the various colonies, could be assembled in this country. There is no reason why such a body could not be easily established, by the Crown appointing to the Privy Council colonists recommended by the legislatures of the different colonies (perhaps, also, ex-governors and judges), who should hold special sittings for consulting upon colonial matters; and we believe that there would be no violation of constitutional law or Privy Council system, as there is no right appertaining to Privy Councillors to attend the council board when not summoned to it. This would violate no constitutional principle or the settlement of any colony, because it is clear that the Queen and her Council are constitutionally part of the general system of imperial government, whether for home or colonial purposes, as is proved by the fact that the Privy Council is acknowledged by most colonies as the Supreme Court of Appeal in law cases. In truth, the Privy Council is constitutionally the only connecting link between the Home and Colonial Governments, and we regret to find that the Lord Chancellor proposes to weaken this connection by abolishing the Privy Council as a Court, and transferring its powers to a Supreme Court of Appeal to be established by an Act of the British Parliament—a mode of dealing with the matter that may possibly raise some opposition to the measure on the part of the colonies, who will doubtless (as has been pointed out by Lord Cairns) object to have the administration of colonial justice regulated by an Act of the Parliament of England, Ireland, and Scotland.

With regard to the difficulties of inventors in obtaining colonial patents, there is one very simple thing that could be done by the Government off-hand, and it is this:—Whenever an inventor requires colonial patents, he should be allowed to deposit the necessary papers at the Colonial Office, to be by that office transmitted to the proper colonial offices, and all communications on the subject should be made to pass through that channel to and from the inventor. Such an arrangement would relieve the inventor of the trouble, difficulty, and expense of postage, professional agencies, and so forth, and would tend to bring the colonial patent system into some little unity of arrangement. The adoption of this plan could not entail any further expense than the employment of an extra clerk, whose salary might be defrayed out of the surplus funds of our British Patent Office.

Reviews.

Elementary Treatise on Natural Philosophy. By A. PRIVAT DESCHANEL, formerly Professor of Physics in the Lycée Louis-le-Grand, Inspector of the Academy of Paris. Translated and Edited, with extensive additions, by J. D. EVERETT, M.A., D.C.L., F.R.S.E., Professor of Natural Philosophy in the Queen's College, Belfast. In four parts. Part III.—Electricity and Magnetism. Illustrated by 241 engravings on wood, and one coloured plate. London: Blackie & Son, Paternoster Buildings, E.C.; Glasgow and Edinburgh. 1872.

THE volume now before us, the third part of this able translation, or, as we might term it, transformation, of Deschanel's well-known treatise, fully sustains the high character of the two former parts or volumes.

The present part is devoted to electricity and magnetism, and is as explicit and readable as anyone, however slight may be his knowledge, can possibly ask or wish for.

In the preface to this volume the editor truly remarks that the accurate method of treating electrical subjects which has been established in this country by Sir Wm. Thomson and his condjutors, has not yet been adopted in France; and some of Faraday's electro-magnetic works are still very imperfectly appreciated by French writers. The editor has found it necessary to recast a considerable portion of the present volume, and to introduce two new chapters (XXXIX[A]. and XLI[A].) and an appendix. Potential and lines of force are, it appears, not so much as mentioned in the original. Dr. Everett says that in this work the elements of the theory of magnetism have been based on Sir Wm. Thomson's papers in the "Philosophical Transactions;" and the description of the apparatus used in magnetic observatories has been drawn from the recently published work of the Astronomer Royal. The account of electrical units given in the appendix is mainly founded on the Report of the Electrical Committee of the British Association for the year 1863. It appears that M. Deschanel's descriptions of apparatus, of which some very elaborate examples occur in the present volume, left little to be desired in point of clearness. In no instance has it been found necessary to resort to the mere verbal rendering of unintelligible details.

The first pages of the book are devoted to fundamental phenomena, and then follows a lucid account of various apparatus for the measurement of electrical forces, which is followed by very full and exact descriptions of different kinds of electrical machines, amongst which one of the most interesting is the electrophorus:—

When electricity is required in comparatively small quantities, it is readily supplied by the simple apparatus called the *electrophorus*. This consists of a disc of resin, or some other material easily excited by friction, and of a polished metal disc with an insulating handle. The resin disc is electrified by striking or rubbing it with catskin or flannel, and the metal plate is then laid upon it. In these circumstances, the upper plate does not receive a direct charge from the lower, but, if touched with the finger (to connect it with the earth), receives an opposite charge by induction. On lifting it away by its insulating handle, it is found to be charged, and will give a spark. It may then be replaced on the lower plate (touching it at the same time with the finger), and the process repeated an indefinite number of times, without any fresh excitation, if the weather is favourable.

The resinous plate has usually a base or *sole* of metal, which is in connection with the earth while the electrophorus is being worked. This sole, by the mutual induction which takes place between it and the upper plate or *cover*, increases the capacity of the latter, and thus increases the charge acquired. When the cover receives its positive charge on being connected with the earth, the sole at the same time receives from the earth a negative charge, and as the cover is gradually lifted this negative charge gradually returns to the earth.

The most convenient form of the electrophorus is that of Professor Phillips, in which the cover, when placed upon the resinous plate, comes into metallic connection with the metal plate below. That this arrangement is allowable is evident when we reflect that, when the upper plate is touched with the finger, it is in fact connected with the lower plate, since both are connected with the earth; and it effects a great saving of time when many sparks are required in quick succession, for the cover may be raised and lowered as fast as we please, coming alternately into contact with the resinous plate and the body which we wish to charge.

Electrical potential and lines of electric force form the subject of an ably written chapter, which is followed by chapters on the subject of electrical condensers and the effects produced by their discharge.

The object and construction of electrometers are treated of in a very explicit manner, and under the head of Atmospheric Electricity lightning-conductors are referred to, and the following rules are given for their construction:—

A badly-constructed lightning-conductor may be a source of danger, instead of a protection. The following conditions should always be complied with:—

1. The connection with the ground should be continuous.

2. The conductor must be everywhere of so large a section that it will not be melted by lightning passing through it. The French Academy of Sciences recommend that the section for iron rods should be nowhere less than 2·25 centimetres, or 9-tenths of an inch.

3. The earth contact must be good. The conductor may be connected at its base with the iron pipes which supply the neighbourhood with water or gas; or it may terminate in the water of a well or pond. Failing these, it should be provided with branches traversing the soil in different directions, and surrounded by coke, which is a good conductor.

4. At no part of its course above ground should it come near to the metal pipes which supply the house with water or gas, nor to any large masses of metal in the house. All large masses of metal on the outside of the house, such as lead roofing, should be well connected with the conductor.

5. The extreme point should be sharp. A former commission of the Academy recommended a platinum point, which should be connected with the iron by welding. But as this construction is both difficult and expensive, later directions have been issued recommending a gilded copper cone screwed on to the iron. This form of termination is better than a needle-point, because less liable to fusion.

The rod has a diameter of 2 or 3 inches at its base, and gradually tapers upwards to the place where the point is screwed on. The descending portion is connected with the base of this rod by the broad band.

The various forms of galvanic batteries are fully explained and thermo-electricity is not forgotten. As to this the following statement is made:—

Electric currents can be produced by applying heat or cold to one of the junctions in a circuit composed of two different metals. This was first shown by Seebeck of Berlin in 1821. It may be illustrated by employing a rectangular frame, having three sides formed of a copper plate, and the fourth of a cylinder of bismuth. It must be placed in the magnetic meridian, with a magnetised needle in its interior. On heating one of the junctions with a spirit-lamp, the needle will be deflected in such a direction as to indicate the existence of a current, which, in the copper portion of the circuit, flows from the hot to the cold junction, and in the bismuth portion from the cold to the hot. If cold instead of heat be applied to one junction, the direction of the current will still be from the warmer junction through the copper to the colder junction, and from this through the bismuth to the warmer junction. Antimony, if employed instead of copper, gives a still more powerful effect.

By the foregoing extracts we have endeavoured to present our readers with some samples of the contents of this truly valuable work; but as the book is illustrated by engravings of nearly every apparatus referred to, our quotations necessarily afford a very imperfect idea of the value of the information conveyed in its pages.

The work is well got up, good paper, good print, has cut edges, is profusely illustrated, and does great credit to the compiler, the publishers, and all concerned in its production.

Rudimentary Magnetism: being a concise exposition of the General Principles of Magnetical Science, and the purposes to which it has been applied. By Sir W. SNOW HARRIS, F.R.S., &c. Second edition, revised and enlarged by Henry M. Noad, Ph.D., F.R.S, Vice-President of the Chemical Society, Author of "A Manual of Electricity," &c. With 165 illustrations. London: Lockwood & Co. 1872.

IN this amplified edition of Sir W. Snow Harris's work, much additional information is given, so as to bring the subject up to the present state of knowledge in this department of scientific research.

The additions to the book are to be found at different parts of it; but the most striking and important of these are contained in chapter viii., which treats of the progress of terrestrial magnetism during the past twenty years. This part of the subject Dr. Noad deals with in the following way:—

The two chief branches into which the science of terrestrial magnetism in its present state may be divided, may be stated to be these. 1. Observations on the actual distribution of the magnetic influence over the globe at the present epoch in its mean or average state, when the effects of temporory fluctuations are either neglected or eliminated by extending the observations over a sufficient time to neutralise their effects. 2. The history of all that is not permanent in the phenomena, whether it appear in the form of momentary, daily, monthly, or annual change and restoration; or in progressive changes not compensated by counter changes, but going on continually accumulating in one direction, so as in the course of many years to alter the mean amount of the quantities observed.

With reference to the first of these two branches, the Report of the Royal Society and British Association goes on to state:—"The three elements, viz., the horizontal direction, the dip, and the intensity of the magnetic force, require to be precisely ascertained before the magnetic state of any given station on the globe can be said to be fully determined . . . and as all these elements are at each point now ascertained to be in a constant state of fluctuation, and affected by transient and irregular changes, the investigation of the laws, extent, and mutual relations of these changes is now become essential to the successful prosecution of magnetic discovery."

With reference to the second branch, viz., the secular and periodical variations, it is observed that "the *progressive and periodical* being mixed up with the *transitory* changes, it is impossible to separate them so as to obtain a correct knowledge and analysis of the former without taking express account of and eliminating the latter"; and with reference to the secular changes in particular, it is remarked: "These cannot be concluded from comparatively short series of observations without giving to those observations extreme nicety, so as to determine with perfect precision the mean state of the elements at the two extremes of the period embraced, which, as already observed, presupposes a knowledge of the *casual* deviations."

With regard to the phenomena designated "casual variations," all that was known, when the Report of the Committee of Physics

was written, was that there occurred occasionally, and, as it was supposed, irregularly, disturbances in the horizontal direction of the needle, which were known to prevail with an accord which it was impossible to ascribe to accident *simultaneously* over considerable spaces of the earth's surface, and were believed to be in some unknown manner connected, either as cause or effect, with the appearances of the aurora borealis. The chief feature by which the presence of a disturbance of this class could be recognised at any instant of observation—or by which its existence might be subsequently inferred independently of concert or comparison with other observatories—appeared to be the deflection of the needle from its usual or normal position to an amount much exceeding what might reasonably be attributed to irregularities in the ordinary periodical fluctuations. The observations which had been made on the disturbances anterior to the institution of the colonial observatories had been chiefly confined to the declination.

A few of the German observatories had recently begun to note the disturbances of the horizontal force; but as yet no conclusions whatever had been obtained as to their laws. By the instructions of the committee, the field of research was enlarged, being made to comprehend the disturbance phenomena of the *three* magnetic elements; and the importance of their examination was urged, not alone as a means of eliminating their influence on the periodic and progressive changes, but also on the independent ground that "the theory of the transitory changes might prove itself one of the most interesting and important points to which the attention of magnetic inquirers can be turned, as they are no doubt intimately connected with the general cause of terrestrial magnetism, and will probably lead us to a much more perfect knowledge of these causes than we now possess."

For the discussion of the laws of "irregular" changes, the magnitude of the departure from the usual or normal state at the instant of observation was made available, and the observations taken at Toronto, Hobarton, and St. Helena have furnished data for the investigation at three points of the earth's surface—one in the temperate zone of the *northern* hemisphere, a second in the temperate zone of the *southern* hemisphere, and a third in the tropics—of the laws, extent, and mutual relation of these transient or irregular changes as affecting the three magnetic elements, viz., the declination, the inclination, and the total force.

One of the results of this investigation is, that the phenomena of this class, which may be termed "occasional," are in their mean or average effects subject to periodical laws of a very systematic character; placing them, as a first step towards an acquaintance with their physical causes, in immediate connection with the *sun* as their primary cause. They have (1) a *diurnal* variation, which follows the order of the solar hours, and manifests therefore its relation to the sun's position as affected by the earth's rotation round its axis. (2) An annual variation connecting itself with the sun's position in regard to the ecliptic. (3) A third variation, which seems to refer still more distinctly to the direct action of the sun, since, both in period and in epochs of maximum and minimum, it coincides with the remarkable period of about ten, or perhaps more nearly *eleven* of our years, the existence of which period has been recently made known to us by the phenomena of the solar spots, but which, as far as we yet know, is wholly unconnected with any thermic or physical variation of any description (except magnetic) at the surface of the earth, and equally so with any other cosmical phenomena with which we are acquainted.

Now that it is become known that the "casual perturbations" are governed by periodical laws, and that these laws and those of the regular "periodical variations" are dissimilar in their epochs, it is manifest that in their joint and undivided effects we have two variations due to different causes, and having distinct laws superimposed upon each other. To know the one correctly, we must necessarily, therefore, eliminate the other.

A careful analysis of the solar-diurnal variation of the declination at the colonial observatories has brought to light the existence at all the stations of an *annual inequality* in the direction of the needle, concurrent with changes in the sun's declination, having its maxima (in opposite directions) when the sun is in or near the opposite solstices, and disappearing at or near the epochs of the equinoxes. An intercomparison of the results of analysis at these stations has shown that this inequality has the remarkable characteristics of having notably the same direction and amount in the southern as in the northern hemisphere, and in the tropical as in the temperate zones.

The consideration of the question is continued by referring to the results of the observations made at various observatories in the British Colonies and at home. Another novel portion of the work as now issued is to be found in the chapter (ninth) which gives an account of Faraday's latest researches, from which we present our readers with the following quotation:—

Analogy of a Magnet with a Voltaic Battery and an Electric Conductor polarised by Induction.—As far as regards the disposition of the *external* lines of force, the analogy is perfect. Faraday magnetised to saturation a very hard steel bar 12 inches long, 1 inch broad, and 0·05 inch thick; its power, as measured by the moving wire, was 6·9°. It was now broken into two pieces nearly in the middle. one half had a power of 5·94°, the other of 5·89°. The two pieces, placed side by side with similar poles, together as a compound magnet, had a power of 11·06°, not much below the sum of the powers of each half ascertained separately, and the loss on each half, as compared with the original bar, was not greater than was to be expected, considering the saturated state of the original magnet.

This is quite in harmony with the voltaic battery, for it is well known that if a battery of twenty plates be separated into two of ten or four of five pairs, each of the smaller batteries can supply as much dynamic electricity as the original battery, provided there be no obstruction to the passage of the current.

But in neither the battery nor the conductor are the lines of force continued *internally*, as is the case with the magnet. Consequently, on separating the conductor or insulated battery in the middle, no change appears there, nor any origin of new lines of inductive force, but the two divided portions remain in *opposite states*, or absolutely changed. In the magnet, on the other hand, there is on division a development of new external lines of force, and no absolute change of northness or southness, because the lines of force are continuous through the body of the magnet.

It has been shown by Ampère and Davy that an electric current has a tendency to *elongate* itself, and that like electric currents *attract* each other, but a magnetic "axis of power" has a tendency to *shorten* itself, and like magnetic lines of force exert mutual *repulsion*. Here a contrast between the electric and magnetic forces seems to be demonstrated, but in reality there is again a coincidence, because the two axes of power are at right angles to each other. Again, *unlike* magnetic lines, when *end on*, as when similar magnetic poles are face to face, *repel*; so also, unlike electric currents, when in the same relation, *repel* also. Like electric *forces*, when end on, *coalesce*; like magnetic forces do the same. Like electric currents end to end do not add to their sums; the quantity of electricity circulating in a battery is not increased by adding to the number of the plates; and like magnetic "lines of force" do not increase each other. Lastly, *like* electric currents side by side (a voltaic battery with large plates compared with one with small plates) add their quantities together, and *like* magnetic forces do the same.

With this quotation we must conclude our notice of an interesting and instructive book, which, we ought to mention, is illustrated by woodcuts introduced at almost every page.

A New Star Atlas for the Library, the School, and the Observatory, in twelve circular maps (with two index plates). Intended as a Companion to Webb's Celestial Objects for Common Telescopes. With a letterpress introduction on the Study of the Stars, illustrated by several woodcuts. By Richard A. Proctor, B.A. (Camb.), F.R.A.S. London: Longmans, Green and Co. 1872.

This atlas is reduced from Mr. Proctor's large star atlas. The advantages of the plan on which it has been constructed he considers to be fully evidenced by the present work; for a little book is here produced which can be carried in the pocket, while the small atlas published by the Society for Diffusing Useful Knowledge is printed on sheets about sixteen inches square; and yet the scale of the accompanying maps is larger than that of the S.D.U.K. atlas. The reduction in size is gained chiefly by a reduction in the distortion of the maps, the maximum expansion due to this cause being *fifty-eight* times greater in the S.D.U.K. maps than in the present. Moreover, the twelve maps of this atlas overlap, a fifth part of the heavens being included in the overlaps; so that each of the twelve maps exhibits a tenth part of the heavens.

The maps have been cleared of all which could cause confusion to the beginner; but this has been done in such a way that the more advanced student may find nothing wanting. For example, the meridians and parallels are drawn in to every fifteenth, instead of every fifth degree (as usual); but, since all the intersections of these lines to every fifth degree are marked in the maps (with a small cross), the places of stars can be determined, from catalogues or the like, as readily as though the lines themselves were marked in. In like manner all the longitude and latitude lines, except the ecliptic and the solstitial colures, are omitted; but their intersections to every fifteenth degree are marked (with a small dotted cross), and any student who is sufficiently advanced to require these lines will be able to recognise very readily where they lie, or to pencil them in if need be. Mr. Proctor states that he considers their omission, and the omission of all but every third of the meridians and parallels usually introduced, to be absolutely essential for the convenience of the majority of those who will use these maps; though the maps would, undoubtedly, be imperfect if the position of these lines were not indicated.

For indicating the effects of precession, instead of a precession-triangle in the corner of each map, with instructions for obtaining compass measurements, precession-arrows are placed over the maps (always on latitude-parallels, 15°, 30°, &c.); and these show at once by what amount stars in the neighbourhood are precessionally displaced in one hundred years.

As to the constellation-figures, they are omitted from the present atlas. The old usage—by which a star's place was indicated by a reference to the club of Orion, or the northern claw of the Crab, or the southern wing of the Virgin, and so on—is falling into disuse; and, as the number or letter of a star is always mentioned, even by those who employ the ancient practice, no difficulty can ever arise in finding any star referred to.

It is important to notice that the present atlas is specially intended to serve as a companion to Mr. Webb's excellent treatise, "Celestial Objects for Common Telescopes." With a very few exceptions, all the objects mentioned in that work are shown in this atlas. The exceptions relate to objects (some twenty in all, perhaps) which could not be introduced without overcrowding. To make

up for these omissions, however, several hundreds of objects not included in Mr. Webb's charming work are shown in this atlas. Thus, all the objects in Admiral Smyth's "Celestial Cycle," all the binary stars in Mr. Brothers's catalogue, all the red stars in Schjellerup's catalogue, all the nebulæ down to the order marked "very bright" in Sir J. Herschel's great catalogue, are introduced here, with only such exceptions (perhaps a score in all) as were necessary to avoid overcrowding. It is hoped that, with this unusual richness in objects of interest, the atlas will prove a complete *vade mecum* for the amateur telescopist.

Mr. Proctor states that he has to thank Mr. Webb for the careful revision of the atlas, so far as the objects to be included in his treatise are concerned. In the course of this revision he has noticed several discrepancies between the constellation outlines in this work (based on the British Association Catalogue) and those used in Smyth's "Bedford Cycle." As Mr. Webb's "Celestial Objects" is closely associated with the "Cycle," he has not thought it desirable to remodel the arrangement of the constellations; and, on the other hand, as this atlas is a miniature of the "New Star Atlas," he would have been unwilling to change the constellation outlines, even if he did not entertain the opinion that Baily's changes result in an immense improvement. The student will therefore be prepared to find that some few objects described in "Celestial Objects" as in one constellation are here shown in another; and even that some constellations mentioned in "Celestial Objects" (as Antinous, Anser, Clypeus, &c.) are here omitted altogether. But no difficulty need arise on this account, because Mr. Webb in every case mentions the right ascension and declination of the several objects.

The letterpress introduction has been prepared for the use of beginners, who often find it difficult to compare the heavens with the maps of a star atlas. Mr. Proctor recommends, as a convenient supplement to the information contained in these pages, his work entitled the "Half-Hours with the Stars," published by (and the property of) his friend Mr. Hardwicke, of Piccadilly. Its twelve maps show how the stars are placed, night by night and hour by hour, throughout the year in England. Thus they serve a purpose wholly distinct from that of such a star atlas as the present. Each work is, however, complete in itself; and, as the "Half-Hours with the Stars" suffices to teach the merest beginner the names and places of all the leading star-groups, so the present will enable the learner to identify all the stars of the first five orders of magnitude; that is, all the stars except the faintest of those seen on very dark and clear nights.

We can confidently recommend this atlas to all students of astronomy; to beginners it must be invaluable.

Principles of Geology; or, the Modern Changes of the Earth and its Inhabitants considered as illustrative of Geology. By Sir CHARLES LYELL, Bart., M.A., F.R.S. Eleventh and entirely revised Edition. In two vols.—Vol. I. Illustrated with maps, plates, and woodcuts. London: John Murray, Albemarle Street. 1872.

THIS is the eleventh edition of Sir Charles Lyell's great work, published after an interval of five years since the issue of the last edition of this first volume of the "Principles of Geology"—a time in which much discussion has taken place on important theoretical points bearing on meteorology and climate, and much new information obtained by deep-sea dredging in regard to the temperature and shape of the bed of the ocean, and its living inhabitants. Sir Charles states that, in order to avail himself of this newly-acquired knowledge, he has found it necessary to recast chapters x., xi., xii, and xiii., which relate to the geological proofs of former changes of climate, and the paramount importance of the distribution and height of the land over all other causes in bringing about past variations of temperature. At the same time he has endeavoured to render more intelligible some of those astronomical changes which must periodically affect climate, though probably not in so influential a degree as some have imagined.

In chapter xx. he has briefly dwelt upon the latest known facts concerning marine currents, especially those in the Straits of Gibraltar, and has considered some theories of oceanic circulation recently propounded to account for the cold of the abysses of the ocean. With these exceptions, the work has been reprinted mainly as it stood in 1867, with corrections and additions.

The changes made in the tenth edition were so numerous and important that he has thought it best to reprint the preface to that edition in full, thereby giving the reader the opportunity of knowing what advance has been made in the work since 1853, when the ninth edition appeared.

This work is now so well known, and Sir Charles Lyell is so well established as an authority on the subject of geology, that it would be superfluous in us to criticise it, whether in a favourable or adverse spirit; we may, however, state that the changes now made in the work are decided improvements. At the same time we think it right to state that, as far as the book touches on cosmogony, we are not disposed to defer to the conclusions it upholds with regard to the immense duration of the earth. In point of fact the modern cosmical changes effected by the agency of the sea, of fire, and of ice, point to the conclusion that mighty results can be achieved in a much shorter time than geologists are willing to allow. There is always so much that is conjectural in geological theories that no one can accept them as immutably established; they must be taken *cum grano salis*, and no other position should be demanded for them.

The Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life. By CHARLES DARWIN, M.A., F.R.S., &c. Sixth edition, with additions and corrections. (Eleventh Thousand.) London: John Murray, Albemarle Street. 1872.

IN this sixth edition of Mr. Darwin's well-known work he has (as we are therein informed) made numerous small corrections on various subjects according as the evidence has become somewhat stronger or weaker. The more important corrections and some additions in the present volume are tabulated in the introductory part of the work for the convenience of those interested in the subject, and who possess the fifth edition. As copies of the present work will be circulated in foreign countries, the following statement as to the foreign editions may be found useful. The third French and second German editions were from the third English, with some few of the additions given in the fourth edition. A new fourth French edition has been translated by Colonel Moulinié; of which the first half is from the fifth English, and the latter half from the present edition. A third German edition, under the superintendence of Professor Victor Carus, was from the fourth English edition; a fifth is now preparing by the same author from the present volume. The second American edition was from the English second, with a few of the additions given in the third; and a third American edition has been printed from the fifth English edition. The Italian is from the third, the Dutch and three Russian editions from the second English edition, and the Swedish from the fifth English edition.

The chief additions to the present edition refer to the following matters:—

Influence of fortuitous destruction on natural selection; on the convergence of specific forms; account of the ground-woodpecker of La Plata modified; on the modification of the eye; transitions through the acceleration or retardation of the period of reproduction; the account of the electric organ of fishes added to; analogical resemblance between the eyes of cephalopods and vertebrates; Claparède on the analogical resemblance of the hair-claspers of the Acaridæ; the probable use of the rattle to the rattle-snake; Helmholtz on the imperfection of the human eye. The first part of this new chapter consists of portions, in a much modified state, taken from chap. iv. of the former editions. The latter and larger part is new, and relates chiefly to the supposed incompetency of natural selection to account for the incipient stages of useful structures. There is also a discussion on the causes which prevent in many cases the acquisition through natural selection of useful structures. Lastly, reasons are given for disbelieving in great and sudden modifications. Gradations of character, often accompanied by changes of function, are likewise here incidentally considered. The statement with respect to young cuckoos ejecting their foster-brothers confirmed; on the cuckoo-like habits of the Molothrus; on fertile hybrid moths; the discussion on the fertility of hybrids not having been acquired through natural selection condensed and modified; on the causes of sterility of hybrids, added to and corrected; Pyrgoma found in the chalk; extinct forms serving to connect existing groups; on earth adhering to the feet of migratory birds; on the wide geographical range of a species of Galaxias, a fresh-water fish; discussion on analogical resemblances, enlarged and modified; homological structure of the feet of certain marsupial animals; on serial homologies, corrected; Mr. E. Ray Lankester on morphology; on the sexual reproduction of Chironomus; on the origin of rudimentary parts, corrected; recapitulation on the sterility of hybrids, corrected; recapitulation on the absence of fossils beneath the Cambrian system, corrected; natural selection not the exclusive agency in the modification of species, as always maintained in this work; the belief in the separate creation of species generally held by naturalists until a recent period.

Although we are not disposed to accept all Mr. Darwin's views and conclusions as correct, yet his ability and position as a scientific writer are so incontestable that it would be impertinence in us to either praise or blame the work before us; all we can say is, that the additions and corrections have added greatly to the value of the work.

A Memoir of John Elder, Engineer and Shipbuilder. By W. J. MACQUORN RANKINE. William Blackwood and Sons, Edinburgh and London. 1872. (Second Notice.)

As Professor Rankine is careful to inform us, Mr. Elder came of a highly respectable and intellectual stock, and received his early education at the High School of his birthplace, Glasgow, where he was born on the 8th of March, 1824. Soon he became distinguished for his knowledge of arithmetic, and an adept in every kind of drawing—an art intimately connected with mechanical science. He afterwards became an apprentice to Mr. Robert Napier, under the direction of his father, working in the pattern-shop, moulding-shop, and drawing-office. He then was employed as a pattern-maker by Messrs. Hick, of Bolton, after which he became a draughtsman on the works of Great Grimsby Docks. In 1852, he joined the firm of Messrs. Randolph, Elliott, and Co., of Glasgow, well known, and of high standing, as millwrights, which at that time undertook the business of marine engineering, and the firm became known as Randolph, Elder, and Co., until 1868, its style being eventually changed to John Elder and Co. About 1860 the firm added shipbuilding to its business.

At this point of the narrative we shall resort to the pages of the work, for they contain remarks that will be appreciated by all engineers and mechanists:—

The career of Mr. Elder as a marine engineer and shipbuilder is so closely connected with the application of the compound expansive steam-engine to the propulsion of ships, that

it now becomes necessary to introduce into this memoir a brief explanation of the principles of that class of steam-engines, and a summary of their history from the time of their first invention.

In every machine a certain quantity of energy, or power of doing work, is expended, in order that a certain amount of work may be done. In every machine, and under all circumstances, the whole work done is equal to the energy expended; but only part of that work is useful, the remainder being useless, so that the energy expended in doing it is wasted. For example, in a pumping steam-engine the useful work consists in raising, in a given time, a certain quantity of water to a certain height: the useless, or wasteful work, is that done in overcoming friction. The proportion which the useful work done bears to the energy expended is called the *efficiency*. In an absolutely perfect machine, the efficiency would be represented by unity—but no such machine exists; and in every actual machine, the efficiency is expressed by a fraction which falls short of unity by an amount corresponding to the energy that is wasted.

In a steam-engine there are several successive causes of waste of energy. In the first place, the whole of the energy which the fuel is capable of producing by its combustion is not communicated to the water in the boiler, but only a certain fraction of that energy, ranging in ordinary cases from six-tenths to eight-tenths: this fraction is the *efficiency of the boiler;* and the amount by which it falls short of unity corresponds to the heat lost by imperfect combustion, by conduction and radiation, and by the high temperature at which the furnace-gas escapes through the chimney.

Secondly, the whole of the energy which in the form of heat is communicated to the water in the boiler, so as to raise its temperature and convert it into steam, is not obtained in the form of mechanical work done by the steam in driving the piston. In fact, it has for some years been known, through the progress of the science of thermodynamics, that the work done by the steam in driving the piston (often called the *indicated work*, because its amount can be registered by a self-acting instrument called the indicator) corresponds to a quantity of energy which has disappeared from the form of heat, being the difference between the heat brought by the steam from the boiler, and the heat carried away by the same steam when it leaves the cylinder. That difference, in every case which can occur in practice, is but a small fraction of the whole heat brought by the steam from the boiler, such as a twentieth, or a tenth; and that fraction is the *efficiency of the steam*.

Thirdly, the whole of the energy exerted by the steam in driving the piston is not communicated to the machine which it is the purpose of the engine to drive; for a fraction of that energy, say from an eighth to a fourth, is wasted in overcoming the friction of the engine—the difference between that fraction and unity being the *efficiency of the mechanism.*

Fourthly, when the machine which it is the purpose of the engine to drive is an instrument for propelling a ship, a fraction of the energy is wasted in agitating the water in which the propeller works, the remainder only being usefully expended in overcoming the resistance of the vessel, and driving her ahead; and the ratio which this last remainder bears to the whole energy expended by the engine in driving the propeller is a fraction called the *efficiency of the propeller.*

The efficiency of the whole combination, made up of furnace, boiler, engine, and propeller, is found by multiplying together the four fractions already mentioned—viz., the efficiency of the boiler, the efficiency of the steam, the efficiency of the mechanism, and the efficiency of the propeller—and is of course a smaller fraction than any of the factors of which it is the product.

The object of improvements in the economy of the marine steam-engine is to increase as far as practicable, consistently with due regard to economy in first cost, each of the four factors of the efficiency.

Judgment, as well as skill, is specially required in applying to practice in marine steam-engineering improvements whose objects are to increase the mechanical efficiency of the furnace and boiler, of the steam in the cylinder, and of the mechanism; for these improvements for the most part tend more or less to increase the cost of construction; and thus there arises in such case the commercial question, Whether the economy in working to be attained by means of a given increase of efficiency is sufficient to warrant the additional expenditure? In deciding that question, regard must be had to many different circumstances—such as the length of the voyage, the intended speed, the price of fuel, and the nature of the traffic. For example, it would be a waste of money and labour to make elaborately-designed boilers and engines of very high efficiency for vessels intended to run short trips between places where coal is cheap and abundant; while for ships designed to make long voyages, with few and distant coaling stations, and expensive fuel, every improvement that increases efficiency may be a profitable investment. It is not sufficient, then, for success in the business of marine engineering, that the engineer should possess knowledge of the mechanical principles of his art, and skill in their practical application—for these qualifications alone might lead him into needless expense in the production of a degree of mechanical efficiency not required by the circumstances of particular cases; he ought also to have a sound judgment regarding the commercial result of the adaptation of engines of a given kind to a given vessel, intended for a given trade.

Those different qualifications are so seldom found united in one man, that the tendency of popular opinion is to regard them as incompatible, and to look especially upon the knowledge, skill, and enterprise which lead an engineer to adopt new or unusual improvements in practice as being fraught with danger to his success in business; and so no doubt they are, unless regulated by commercial sagacity.

The success of Mr. Elder and of his firm proved that his commercial sagacity was not inferior to his knowledge, skill, and enterprise, and that his was one of those rare minds in which was realised that uncommon combination of talent.

Professor Rankine proceeds to point out in detail the various improvements effected by Mr. Elder (aided by his firm), in which he practically availed himself of the principles of thermodynamics, then considered a novelty. This is done in such a way that the book may be said to comprise a brief treatise on the subject, a sample of which will be found in the following extract:—

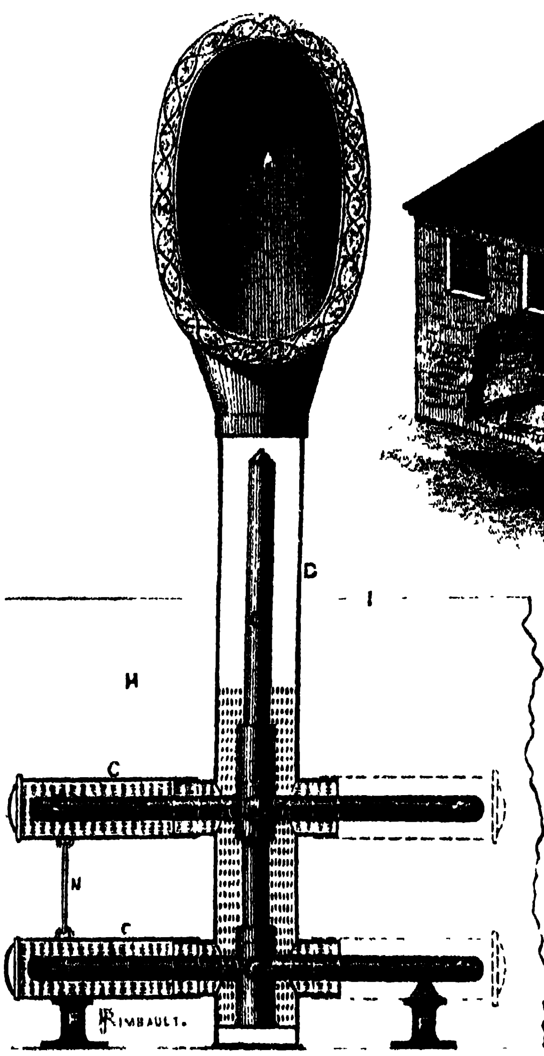
In order to realise the greatest theoretical efficiency in the expansive working of steam, the expansion ought to take place in a non-conducting cylinder, with a non-conducting piston. This condition cannot be absolutely realised in practice; but means may be taken to diminish the loss of efficiency arising from the conducting power of the cylinder and piston until it becomes unimportant.

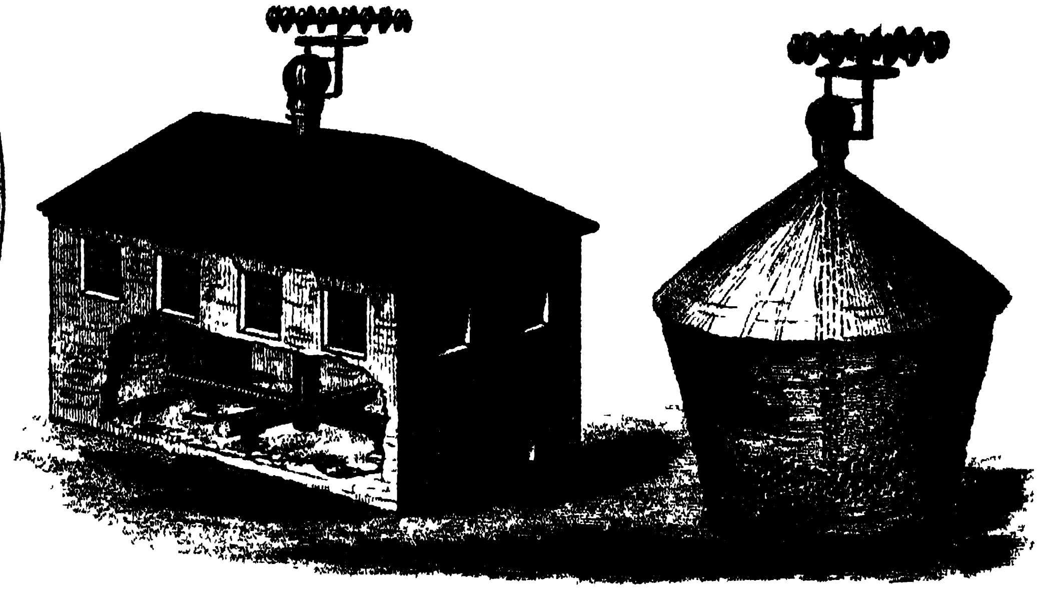
If that loss arose solely from the waste of heat by its passage through the metal of the cylinder to the air outside, it would be sufficient for its practical prevention to clothe the cylinder with bad conductors, such as wood and felt. But by far the greater part of that loss arises in a different and more complex way, which was not thoroughly understood until about 1849 or 1850, when the consequences of the disappearance of heat in performing mechanical work were demonstrated. Until that time it was erroneously believed, from reasoning based on the hypothesis of caloric, that a given weight of steam, after performing work by expansion, contained exactly as much heat as before, and was therefore superheated; because the quantity of heat sufficient to keep it in the vaporous state at the higher pressure was more than sufficient to produce the same effect at the lower pressure; and that statement was so confidently believed that it was distinctly laid down as a fundamental principle in all, or almost all, writings on the theory of the steam-engine.

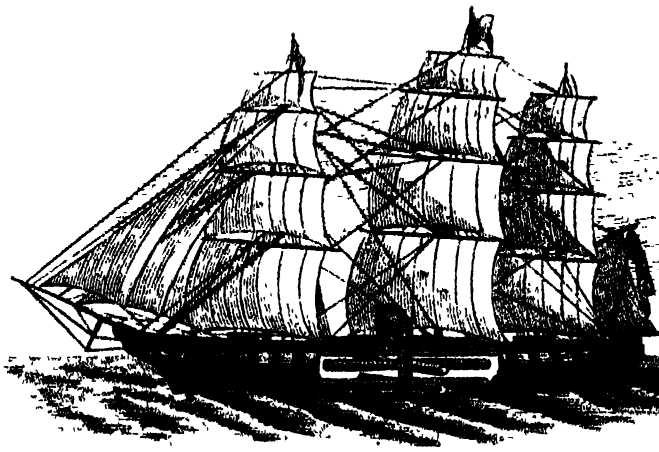
One of the earliest consequences deduced from the principles of thermodynamics was that when steam performs work by expansion, a quantity of heat disappears sufficient not only to lower the temperature of the steam to that corresponding to its lowered pressure, but to cause a certain portion of the steam to pass into the liquid state. The steam thus spontaneously liquefied collects in the form of water in the cylinder; and if the cylinder and piston were made of a non-conducting material, that water would simply be discharged from time to time into the condenser, without causing any waste of heat. But the cylinder and piston, being made of a conducting material, give out heat to the liquid water which adheres to them, so as to re-evaporate it when the communication with the condenser is opened; and that heat is carried off to the condenser with the exhaust-steam, leaving the piston and the inside of the cylinder at a low temperature, even though the outside of the cylinder should be clothed with an absolute non-conductor. When steam from the boiler is admitted at the beginning of the next stroke, part of it is immediately liquefied through the expenditure of its heat in raising the piston and the inside of the cylinder again to a high temperature, the result being that at the end of the second stroke the quantity of liquid water which is re-evaporated, and carries off heat to the condenser, is greater than it was at the end of the first stroke. At each successive stroke that quantity augments until it reaches a fixed amount, depending mainly on the difference of the temperatures of the steam at the beginning and end of the expansion; and the effect is the same as if a certain quantity of steam at each stroke passed directly from the boiler to the condenser without performing work. In some experiments lately made, the quantity of steam which thus ran to waste was found to be greater than that which performed work; so that the expenditure of steam was more than doubled.

The remedy for this cause of loss is to prevent that spontaneous liquefaction of the steam during its expansive working, in which the process just described originates; and that is done either by enclosing the cylinder in a *jacket* or casing supplied with hot steam from the boiler, or by superheating the steam before its admission into the cylinder; or by both those means combined. The steam is thus kept in a nearly dry state, so as to be a bad conductor of heat; and the moisture which it contains, though sufficient to lubricate the piston, is not allowed to increase to such an extent as to carry away any appreciable quantity of heat from the metal of the cylinder and piston to the condensers.

The steam-jacket outside the cylinder was invented and used by Watt. Whether he fully understood the nature of its action can never be known; for he did not publish any reason for using it except that of keeping the steam as hot as possible. Its real action was certainly not understood by Watt's immediate successors, nor indeed by any one, until the principles of thermodynamics were applied to the question about twenty years ago; and many engineers, reasoning correctly from the erroneous hypothesis of caloric, concluded that the steam-jacket was unnecessary, and abandoned its use. The fact of liquid water collecting in the cylinder was known, but was ascribed to "priming," or the carrying of spray from the boiler. The use of the steam jacket was retained in a few special kinds of engines, such as the Cornish pumping-engines; and in them the economy properly due to high rates of expansion of the steam was realised; but in almost all other engines, and certainly in marine engines, the jacket was abandoned, with this result—that little or no practical advantage was found to result from expansive working when the steam was expanded to more than about double, or two and a half times its original volume; and this became a received







maxim amongst engineers, and especially amongst marine engineers, for its truth in the case of unjacketed cylinders was established by practical experience, as well as by experiments made for the purpose of testing it.

The jacketing of the piston, by filling its internal hollow with hot steam from the boiler, was invented by M. Normand of Havre, and introduced into Britain by Mr. Davison at a comparatively recent date, after the action of the steam-jacket had been explained according to the principles of thermodynamics, and its use revived in practice.

Space will not permit us to follow Professor Rankine in his very able dissertation on this subject. We must, therefore, content ourselves with referring our readers to the book itself, wherein they will find that Craddock designed compound engines, patented them at different times from 1840 to 1846, but that Mr. Elder produced practical engines of that nature at a later date.

The work follows out the details of the life of John Elder, which terminated 17th of September, 1869, at the early age of 45. His funeral was, it appears, "one of the most impressive sights ever witnessed. The busy works south of the Clyde were shut, forge and hammer at rest, and silent as the grave. The forest of masts along the river were draped in flags, lowered half-mast in sign of mourning. A very army of workmen, dressed like gentlemen, followed his body—column after column. Respectful crowds lined the streets, as if gazing on the burial of a prince; and every one of us, as we took the last look of his coffin and left his grave, felt that we had left a friend behind us."

(*Continued on page 77.*)

PRESERVATION OF CORN, GRAIN, AND SEED FROM MILDEW, HEATING, &c.

The object proposed to be effected by this invention is the important one of protecting corn, seed, and similar commodities stored in bulk from heat, mildew, mustiness, &c., which occasion the loss of thousands of pounds annually to those concerned in such produce.

The inventor and patentee, Mr. Jean Methodios Joannides, a Greek subject, of 24, Mark Lane, London, agricultural engineer, late Greek Consul in Wallachia, and for many years connected with the corn trade, having for several years tried a number of different means to remedy this evil, has at last contrived a most successful and simple apparatus, which he terms "The Anti-Mildew Grain and Seed Protector."

The value of this apparatus is considerably enhanced by its capability of being employed at the present time for three distinct purposes, namely:—

1. In ships on their voyages. Corn and seeds constantly arrive much heated, which occasions immense loss to shippers annually. A reference to the corn list will show the state in which corn daily arrives.

2. In granaries, warehouses, &c., where, to avert the consequences of heat, it is the custom to turn over the corn by hand-labour or by complicated machinery in order to keep it sweet, which entails great expense; all which may be removed by employing the anti-mildew apparatus, and the first expense would be the only one.

3. The invention is also applicable for stacks of hay, clover, &c., which frequently become heated, mildewed, and sometimes fired from spontaneous combustion.

The apparatus for carrying out the above objects consists of a perpendicular cylinder of metal, wood, or other suitable material, with eight (more or less) horizontal cylinders or pipes of like material, all connected with and branching from the perpendicular cylinder. The said cylinders, both perpendicular and horizontal, are perforated with small holes for the circulation of the air, but so as not to allow of the grain or seed, &c., passing through. A series of small tubes are placed in the inside of the large ones for the return of the confined air, and to keep up the circulation.

The apparatus thus formed is placed in the ship, or wherever the grain, seed, &c., may be stored, the perpendicular cylinder projecting above into the open air having attached to it a funnel-mouthed ventilator, also sponges chemically prepared for purifying the air before its admission into the cylinder. Thus fresh atmospheric air is introduced down the perpendicular into the horizontal cylinders, the air passing through the small perforated holes into and generally about the seed or grain that may be stored, and by this means it is, and has been found to secure the object in view.

To more fully explain the invention reference is made to accompanying drawings, the same letters referring to like parts throughout.

DESCRIPTION OF DRAWINGS OF THE APPARATUS.

A—Funnel-shaped ventilator.

B—Section of perpendicular cylinder with small holes or perforations.

C—Sections of horizontal cylinders with same.

D—Interior pipes for keeping up the circulation.

E—Mouth or opening of pipes D.

F—Standards for supporting lower horizontal pipes and apparatus generally.

G—Inner openings of pipes D.

H—A compartment in the ship or other place containing the grain, seed, &c., with the apparatus introduced therein.

I—Deck of ship.

K—Sponges chemically prepared for purifying the air as it passes into the cylinders.

N—Supports for the upper horizontal pipes.

A cap is provided for the cylinder B when the funnel ventilator is removed.

In addition to the above-described apparatus, our illustration shows by separate views the invention as applied to a granary, to a haystack, and to a ship.

The sole agents and vendors of this invention are Messrs. Adutt, Finzi, & Co., 24, Mark Lane, London, who receive orders for immediate execution, and from whom every information can be obtained. This subject is to be submitted for discussion at the next meeting of the Inventors' Institute.

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ESTABLISHED 1ST MAY, 1862.

Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c, from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868.
LORD RICHARD GROSVENOR, M.P.

Chairman of the Council

SIR ANTONIO BRADY.

MEETINGS DURING THE PRESENT MONTH

THURSDAY, MAY 9TH, at Eight o'clock p m, a Paper will be read "On New Inventions for Preserving Grain Corn from Mildew, Heating, &c.," by Mr J. M JOANNIDES.

THURSDAY, MAY 23RD, at Two o'clock p m precisely, Annual General Meeting for receiving the Annual Report, Balance Sheet, and Statement of Accounts, for the Election of the Council for the ensuing year, and for General Business.

At Eight o'clock same evening a Paper will be read "On Inventions relating to Telegraphy," by F. H VARLEY, Esq.

R. MARSDEN LATHAM, *Secretary.*

Members whose subscriptions are now due will please to forward the same to the Collector, Mr. G A. Stretton, 4, St. Martin's Place, Trafalgar Square, London.

SPECIAL NOTICE.

The Council of the Institute have during the past month been endeavouring to concentrate the attention of the Institute on the subject of the best method and means of organising its action in regard to the Patent Laws, it being expected that the report of the Select Committee of the House of Commons on the subject will be shortly issued.

On 28th March the Council brought the subject before the members of the Institute then present, when it was resolved that the matter should be left in the hands of the Council, as urgent business requiring immediate attention.

Mr. F H. VARLEY, Vice-Chairman of the Executive, has acted as Chairman, and various important suggestions were made at that meeting by that gentleman, as also at the meeting on 11th April by Messrs. M. M. HARRIS, C. G. CARTTAR, H BYFARINGTON, R. M. LATHAM, F W. CAMPIN, W. H. TOOTH, and others, all which will be reported in due course.

Monthly Notices.

Danks' Puddling Machinery.—Opening of London International Exhibition, 1872.—National Swimming Baths Company.—Institution of Naval Architects.—Mr. P. Birch's Sewage Scheme.—Society of Biblical Archæology.

DANKS' puddling machinery has recently occupied the public attention, and its merits have been very generally admitted. Mr. Danks' claims as an original discoverer have, however, been disputed by other persons, and amongst those who put in counter claims it appears our respected correspondent, Mr. W. H. Tooth, must be included. We cannot find space for the insertion of Mr. Tooth's case in this number, but we hope to present it to our readers next month.

The London International Exhibition of 1872, being the second of the series of annual international exhibitions of selected works of fine arts (including music), industrial art, and recent scientific inventions and discoveries, under the direction of Her Majesty's Commissioners for the Exhibition of 1851, has now commenced, the official reception and private view being on the 27th April by H.R.H. the Duke of Edinburgh, on behalf of H.R.H. the President. The arrangements of the present exhibition show decided improvement, and, doubtless, the energetic management which is in action at South Kensington will do much to secure success.

Amongst the movements of the day is the National Swimming Baths Company, Limited, for providing baths in the Thames, and on rivers and lakes, with filtered water of uniform depth and temperature. As a commencement, the company has, it appears, entered into a contract for the construction of a covered and well ventilated iron bath, to be placed in the Thames off Battersea Park. The plans have, it is stated, been deposited with the Conservators of the River Thames and the First Commissioner of Her Majesty's Works and Public Buildings, and have received their sanction. The bath is to be ready in May or June next.

We are glad to find that the last session of the Institution of Naval Architects was a most successful one. The papers we may specially mention as worthy of notice were by Mr. Merrifield, F.R.S., the hon. secretary, on Torpedos; by Mr. F. J. Bramwell, on Steam Launches; by our esteemed friend, Mr. J. M. Hyde, on Armour-Plated Ships; and by Professor W. J. M. Rankine, F.R.S., on the Rolling of Ships.

Mr. R. W. Peregrine Birch, A.I.C.E, F.G.S., has recently published a scheme for the irrigation and filtration of the portion of the Thames Valley between Teddington and Shepperton, by means of the sewage from the riverside villages of the district, raised by pumping on to land fit for its reception. He states that the Conservators' rule, as laid down at present, is capable in most cases of being complied with, although in many the cost would be ruinous; but as Parliament has thought it necessary, for the sake of the metropolitan drinking water, to make small villages purify their sewage to such an extent before letting it run into the Thames, we may, he thinks, be justified in expecting, and the Londoners in demanding, that the standard of purity shall be raised as the population of the Thames Valley increases. The possibility of this occurring has led him to regard as unfit for sewage purposes any land draining directly or indirectly into the Thames above the intakes of the Metropolitan water companies. He is also of opinion that it would be an experiment of too grave a character to establish a sewage farm in such a position that the effluent sewage could mix with any water that is drunk, whether such be raised from wells or open watercourses. From these remarks it will be seen that the land from which he considers that effluent sewage can, with safety to the neighbourhood, be allowed to flow, is limited to that lying close to a watercourse from which no water is drunk.

We have received a notice from the Society of Biblical Archæology, meeting at 9, Conduit Street, W. In this notice it is stated that a meeting of the society will be holden on Tuesday, May 7th, 1872, at half-past eight, when papers will be read:—1. On Underground Jerusalem, more particularly the plateau of the Haram es Shereef, by William Simpson, Esq., F.R.G.S. 2. Some Observations upon the so-called New Moabite Stone, described in the *Times* of 26th January, 1872, by R. G. Jenkins, Esq. 3. Some Mathematical Observations on the Dimensions of the Base of the Great Pyramid, and the Royal Coffer, by Solomon M. Drach, Esq., F.R.A.S., F.R.G.S. It is also stated that a very ancient Hebrew Pentateuch from Aden, dating, it is believed, from the tenth century, and probably unique, has been presented to the society by Capt. F. W. Prideaux, Assistant Political Resident at Aden. This interesting M.S. will be exhibited during the evening, together with the report of a committee appointed to examine the same.

Proceedings of Societies.

THE INSTITUTION OF CIVIL ENGINEERS.

At the meeting held on March 19, 1872—T. Hawksley, Esq., President, in the chair—the paper read was "On the Conditions which favour and those which limit the Economy of Fuel in the Blast Furnace for Smelting Iron," Mr. I. Lowthian Bell, Assoc. Inst. C.E.

During the last session of the Institution an account of two blast furnaces, then recently erected at Newport, near Middlesbrough, was given by Mr. B. Samuelson, M.P., M. Inst. C.E. In the discussion upon that communication, the author of the present memoir held that, after certain dimensions of a furnace were attained, no further advantage from subsequent enlargement was possible, so far as fuel consumption was concerned. This condition was based on there being, according to his views, an actual evolution of heat near the throat of the furnace, which maintained a tolerable constancy of temperature in the escaping gases; and also that, as soon as sufficient time had been afforded to admit the requisite saturation of those gases with oxygen, no good could arise from their further retention among the materials. This latter condition likewise involved the useful limit to high temperatures in the blast, for it would be shown that any increase of energy in the reducing power of the gases, acquired by a greater intensity of heat, was neutralised by a corresponding loss of fuel. In opposition to these views it was alleged that no such heat evolution as had been referred to took place in the upper zone; that there existed no limit whatever to a useful increase in the temperature of the blast; and that furnaces might still be profitably enlarged, provided some modification of form was introduced.

The subject of economising fuel, in a process consuming nearly one-sixth of all the coal raised in the empire, justly excited much attention; but as this branch of the question was only incidentally brought forward on the previous occasion, the author now proposed to deal exclusively with the working of the apparatus. When a scientific metallurgist approached the inquiry of fuel consumption in the production of pig iron, he must first satisfy himself in respect to the quantity of heat absorbed in the process, and then, by estimating the calorific power of the fuel, he must determine the weight of combustible necessary to afford the required effect. The real difficulty in the calculation did not consist in ascertaining the actual quantity of heat necessary for the process, but in determining the proportion of the fuel that could be converted into carbonic acid and into carbonic oxide respectively, as there was an evolution of 8000 heat units, Centigrade scale, for one unit of carbon, in the former case, and of only 2400 in the latter. Assuming that the ore yielded 40 per cent. of pig iron, and required fifteen cwt. of limestone as a flux, then the heat absorption per ton of metal in the four divisions of the furnace was, in the zone of fusion 34,900 units, in the zone of heat interception 2500 units, in the zone of limestone decomposition 11,310 units, and in the zone of reduction and carbon impregnation 35,490 units, to which must be added for loss in the escaping gases 8800 units, making a total of 93,000 units. To ascertain the actual quantity of coke required to produce a ton of iron under the circumstances described, there must be deducted from the total number of heat units absorbed, otherwise than those derived from the combustion of the fuel, say 38,000, leaving to be supplied by coke 55,000 cwt. heat units, which, divided by 2400, gave their equivalent in pure carbon to be equal to 22·9 cwt., and the carbon absorbed by the iron being 0·6 cwt., there remained a total of 23·5 cwt of pure carbon, which was equal to about 25½ cwt. of ordinary Durham coke.

It required but a moderate acquaintance with the simpler laws of heat and chemical action to realise some of the conditions which regulated the action of the blast furnace. In the lowest zone the act of fusion and its accompanying decompositions might be said, as a matter of speed, to be regulated by the rapidity with which the carbon was oxidised, and this, for all practical purposes, was settled by the rate at which the blast was injected at the tuyères. It was widely different with the interception of heat, which required time for its accomplishment; hence, if the furnace was too low, the ascending gases would not have time to communicate their sensible heat to the descending solids, and the latter would, in consequence, arrive at so low a temperature at the tuyères as to demand an addition to the fuel which had to liquefy the metal and slag. These considerations involved the question of the height of the blast furnace, and the quantity of work it was capable of performing. The dimensions which would enable an iron smelter to produce a ton of metal with 25½ cwt. of coke burnt with cold blast, from ordinary clay ironstone, were at present to some extent a matter of speculation. At Lilleshall, however, foundry iron was now obtained at an expenditure of 27½ cwt. (in place of 40 cwt) with cold air, from the ordinary ironstone of the coal measures, yielding a trifle above 40 per cent. Furnaces able to produce a ton of pig iron, under the circumstances described, with from 27 to 28 cwt. of coke, had not been in use more than nine years, prior to which they rarely exceeded 50 feet in height, with a capacity of 6000 or 7000 cubic feet. In considering the nature of the change of action which would suffice to account for so marked an economy in the quantity of combustible required to produce the same result, as a reduction from 40 to 27½ cwt, it was necessary to keep in view a few of the facts connected with the action of the oxides of carbon on the iron oxides, as well as on the metal itself. These were explained, and it was stated that they had been the subject of a lengthened experimental research, the results of which were embodied in an article on the "Chemical Phenomena of Iron Smelting," published in the *Journal of the Iron and Steel Institute*. The mode of avoiding the loss from the decomposition of the carbonic acid generated by the reduction of the oxide of iron was to secure the latter operation being performed under circumstances where the temperature was elevated enough to deoxidise the ore, but was not sufficiently intense to have the resulting carbonic acid split up by carbon. This was secured by removing the region in which reduction, and also carbon impregnation, took place to a sufficient distance from the zone in which the materials were too intensely heated by the ascending gases.

The position of what might be designated a perfect form of furnace had been thus far considered, without reference to the progress of events, or the order of improvement which led to its adoption. It was not so, however, in the year 1827, when a height of furnace of 50 feet, with a capacity of from 4000 to 6000 cubic feet, fulfilled all the requirements deemed necessary by the iron smelter. About the year named, the late Mr. J. B. Neilson, M. Inst. C.E., conceived the idea, that by heating the air before it entered the blast furnace an increased intensity of temperature would ensue. At the period of its introduction the "hot blast" constituted one of the most remarkable events in the history of the iron trade. Before attempting to point out what the author believed to afford the true explanation of the theory of the hot blast, he directed attention to one or two circumstances in connection with its applications which, in his opinion, had been too little considered by those who had examined the subject. Thus, in treating Scotch black band, for every ton of iron made there was produced about half a ton of slag; so that in the hearth there had to be fused 30 cwt. of material, effected in the days of cold blast with 60 cwt. of coke. In Wales, and in some parts of England, the weight of slag was about 30 cwt to the ton of iron, giving 50 cwt to be melted at the tuyères; and this was done with 40 cwt. of coke. In France, M. Dufrénoy mentioned cases where 20 cwt. of iron and 30 cwt. of slag were fused with 25 cwt. of fuel, the air used being cold. Equally disregarded, as a matter of argument, had been the great difference of effect produced by the application of hot blast in the three instances quoted. In Scotland raw coal took the place of coke; but there was little doubt, were coke still employed, 30 cwt. would be amply sufficient with hot blast to do the work of 60 cwt. when cold air was used, giving 30 cwt. as the saving of furnace fuel. In England and Wales, for the cases given, 10 to 12 cwt. of coke was all the economy realised by the change from cold to hot air; and in France, upon the occasion alluded to by M. Dufrénoy, the saving, if any, was so unappreciable, that he reported the results there to be "unfavourable to the use of hot air."

The law which, the author believed, determined the weight of fuel required to smelt ores of different kinds, and which constituted the value of the hot blast, was that the rate of reduction should not proceed less rapidly than that of fusion. When a furnace was driven with cold air and was of inadequate height, it had been shown that there was a loss of fuel; and this was explained by the fact that the reducing gases escaped before they had absorbed all the oxygen they were capable of holding, and before they had divested themselves sufficiently of the sensible heat they contained. To retard fusion of a given quantity of iron and slag, less ore and flux were given to be melted; and thus in a furnace of inferior dimensions the two functions were brought into harmony, of course at an expenditure of fuel. It by no means, however, followed that the quantity of fuel required to bring these two operations, fusion and reduction, into unison was the same in every case. In ores of similar richness this would be so did the oxide of iron they contained yield its oxygen with equal facility. This the author had convinced himself was far from being the case, and hence it need only be supposed that the Scotch black band was one-half longer time, or thereabouts, in surrendering its oxygen than another ore, to be satisfied that it was necessary to retain it one-half longer time in contact with the reducing gases. It had been demonstrated at the Clarence Iron Works, by many weeks' experience, that reducing the speed at which a furnace was driven was productive of no benefit, from the escaping gases rising in temperature. Time, then, was the element which was required to make amends for the want of readiness with which a particular ore parted with its oxygen; but this was not the only disposable means, for the same result could be secured by a very moderate alteration of temperature. Thus, calcined Cleveland stone at 410° Cent (770° Fahr.) lost 37 per cent. of its oxygen; but when the heat was raised to that of dull redness, it was deprived of nearly double that quantity, the time of exposure being the same in each case. That it was time alone which effected the change, and not any mysterious virtue in the heat of the blast, was proved by experience at Lilleshall, where, by heating the air of a 53-feet furnace, precisely the same result in point of economising fuel followed as was obtained by raising the furnace to a height of 71 feet.

It had now been shown that in the matter of fuel consumption a 71-feet cold blast furnace performed as perfectly as one driven with heated air, and having an altitude of 53 feet. The latter, it was true, turned out a larger make of iron (probably 200 tons as against 130 tons per week); but the former, without any apparatus to maintain or fuel to expend for heating the air, was able to do its work as efficiently in point of fuel consumed in the furnace.

There still remained to be considered the possibility of constructing a furnace so large as to dispense altogether with the use of hot air without any sacrifice of the fuel used in the furnace itself; and afterwards to examine the effect of uniting the benefit derived from a high temperature of blast with that obtained by

enlarged capacity. The first portion of this inquiry had already been answered, by showing that a reduction of 12¼ cwt. of coke was effected upon an ore only requiring, in a 53-feet furnace, 40 cwt. of this combustible. In the next place, supposing, into a furnace sufficiently large to enable the ascending gases to divest themselves of their sensible heat and to become saturated with oxygen instead of cold air, the blast was admitted at a temperature of 932° Fahrenheit, then the same effect in point of increase of intensity would follow as happened when the blast was changed from cold to hot in the lesser furnace; and some of the extraordinary consequences supposed to be due to this additional intensity of heat in the hearth should manifest themselves, if the value of the hot blast were dependent thereon. Such, however, was not the fact, for the furnace having now sufficient capacity to permit the two functions of fusion and reduction to proceed in point of time in unison with each other, instead of one heat unit in the blast doing the work of three or four previously evolved by the fuel, each unit of heat thrown in with the air did no more duty than one unit produced by the combustion of coke in the inside of the furnace. With combustible matter of the same commercial value, it would no doubt be simpler to obtain the necessary heat by the direct action of the blast on the fuel in the hearth of the furnace. Inasmuch, however, as the air was now heated by the escaping gases, or by coal of little value, there was, in spite of the law just referred to, a notable advantage in the source of heat rendered available by Mr. Neilson's invention. The question, therefore, was the extent to which it could be substituted for that generated by the more expensive description of fuel used in the furnace. The chemical laws already alluded to, which regulated the power of carbonic oxide to deoxidise an ore of iron in presence of a gas having a contrary tendency, such as carbonic acid, imposed a limit to the substitution of mere heat for heat accompanied by the carbonic oxide, the generation of which served as its source. In treating the ironstone of Cleveland, if 25½ cwt. of coke, burnt under favourable conditions, could smelt a ton of iron with cold air, 4 cwt. of such coke could be saved if into the furnace a quantity of heat could be introduced with the blast representing the 4 cwt. in question. Supposing, however, that instead of being content with the blast being heated just enough to afford an economy of 5 cwt., which would be about 905° Fahr., the temperature was raised to, say 1472° Fahr. This addition to the heat resources of the furnace would immediately be felt all over its contents, and as soon as it reached the zone of reduction where the temperature was such that the carbonic acid therein generated was inert on carbon, this condition of things experienced a complete change, and the superheated carbonic acid now dissolved coke, which was productive of loss, both from the cooling effect of the reaction and from the actual diminution of fuel arriving for combustion at the tuyères. Actual experience demonstrated that excessive heat was simply wasted in the blast furnace to which it was applied. Where, however, mechanical difficulties prevented a particular kind of ore being treated in a sufficiently capacious furnace, the structural defect found, no doubt, a valuable remedy in superheated air. The results of repeated observation had shown that a furnace 80 feet high, with a capacity of 12,000 cubic feet, emitted the gases as cool as one twice that size. Larger and larger dimensions were adopted in the North of England, until a capacity of 41,000 cubic feet had been reached, without, in the author's opinion, any commensurate advantage.

The question of obtaining a minimum temperature in the escaping gases, representing as it did in the largest furnaces 2 to 3 cwt. of coke, had been made the subject of direct experiment. This was performed by removing the calcined ironstone from the burden of a blast furnace, and replacing it with an equal weight of slag and flints upon which carbonic oxide was inert. The result was, as soon as the ironstone was taken off, the temperature fell, and only began to rise again when it was replaced, proving that the reduction of oxide of iron was accompanied by an evolution of heat.

The study of the conditions which determined the question of the quantity of fuel required to produce a ton of pig iron was attended with considerable labour, and no inference could be drawn on the probable behaviour of one ore by observations on another. Indeed, the phenomena connected with the operations of the blast furnace were liable to be affected by so many disturbing causes, that much caution was required to avoid arriving prematurely at any fixed opinions on the nature of a process so complicated as that of iron smelting.

ZOOLOGICAL SOCIETY OF LONDON.

At the meeting held 19th March, 1872—John Gould, Esq., F.R.S., V.P., in the chair—the secretary read a report on the additions that had been made to the Society's collection during the month of February, 1872, amongst which were specimens of the Sumatran rhinoceros, two-wattled cassowary, and other rare animals. Mr. R. B. Sharpe, F.Z.S., exhibited some specimens of blue-rock thrushes from Europe and Eastern Asia. After tracing the different plumages through which *Petrocossyphus cyanus* passed, he came to the conclusion that the Eastern blue-rock thrush, *P. solitarius*, eventually becomes entirely blue, like the European species, and that the bird usually called *P. manillensis* and *P. affinis* are merely stages of plumage of *P. solitarius*. Major Godwin Austen, F.Z.S., exhibited a skin of *Coriornis blythii*, which had been obtained by Mr. Roberts, of the Indian Topographical Survey, in the Naga Hills. Mr. Sclater exhibited and made remarks upon a specimen of the American yellow-billed cuckoo (*Coccyzus americanus*) which had been obtained near Buenos Ayres. A communication was read from Professor A. Macalister, of the University of Dublin, containing notes on a specimen of the broad-headed wombat (*Phascolomys latifrons*). A communication was read from Mr. W. E. Brooks, C.E., of Etawah, India, containing remarks on the imperial eagles of India, *Aquila crassipes* and *A. bifasciata*. A paper by Dr. J. E. Gray, F.R.S., was read, containing observations on the genus *Chelymys* and its allies from Australia. Sir Victor Brooke, Bart., F.Z.S., read a paper on *Hydropotes inermis* and its cranial characters as compared with those of *Moschus moschiferus* and other Cervine forms. Major Godwin Austen, F.Z.S., read descriptions of new land and fresh-water shells which he had recently met with in the Khási, North Cachar and Naga Hills of N. E. Bengal. Mr Howard Saunders, F.Z.S., read some notes on the introduction of *Anser albatus* of Cassin into the European avifauna, and exhibited two examples of that species lately shot near Wexford, in Ireland.

VICTORIA (PHILOSOPHICAL) INSTITUTE.

A meeting of this Institute took place at 8, Adelphi Terrace, Strand, 18th of March—Charles Brook, Esq., F.R.S., in the chair. Several additional members were elected, and, in announcing their names, Captain F. Petrie, the honorary secretary, stated that thirty-seven new members had been admitted since January, which was an improvement even on last year, when ninety-one had joined. Dr. Bateman then read a paper on "Darwinism tested by recent Researches as to the Localisation of the Faculty of Speech." Having called attention to Mr. Darwin's statement, that the difference in mind between man and the higher animals was only one of degree, and not of kind, he proceeded to show that such could not be the fact, and instanced the faculty of articulate language, a distinctive attribute of which there was no trace in the ape or other animals. After defining articulate language, he demonstrated that it was exclusively man's prerogative, and there was no analogy between it and the forms of expression common to the lower animals. He then stated that it had been thought that a particular part of the brain was the seat of language, and, if it were so, the Darwinian might contend that, as there was a certain similarity between the brain of man and of the ape and other animals, that they had the *germs* of the faculty. He then cited many cases which had been brought under the notice of German, French, American, English, and other surgeons, to show that even where various portions of the brain had been injured or destroyed, the faculty of speech remained. He concluded by stating that the faculty of articulate speech seemed to be an attribute the comprehension of which was at present beyond us. The discussion which followed was remarkable, as showing how various are the views held by many on the subject.

THE INSTITUTION OF CIVIL ENGINEERS.

At the meeting of this society on Tuesday evening, April 9th, 1872—Mr. Hawksley, President, in the chair—twenty-one candidates were balloted for and declared to be duly elected, including three members, viz., Sir John Gay Newton Alleyne, Bart., Butterley Iron Works, Alfreton; Mr John Robinson, Manchester; and Mr. Edward William Young, Resident Engineer of the Glasgow and Cape Breton Railway; and eighteen Associates, viz., Mr. James Smyth Benest, late Surveyor to the Norwich River Commissioners; Mr. Joseph Bray, Westminster; Mr. Joseph Cash, Stud. Inst. C.E., Assistant Engineer to the Brighton and Hove General Gas Company; Mr. Edmund Compton, Ceara, Brazil; Mr. Robert Edwards, Deal; Mr. William Forrest, Blackburn; Mr. Antonio Gabrielli, Westminster; Mr. John Joseph Grinlinton, Assistant to the Surveyor-General of Ceylon, Captain George Lane Cockburn Merewether, R.E., Ex. Engineer, P.W.D., Bombay; Mr. Berkeley Paget, London Agent of the Low Moor Iron Company; Mr. Richard Steven Roper, Newport, Mon.; Mr. George Bennet Ross, Engineer and Surveyor to the Colonial Company, Trinidad; Mr. Arthur Henry Whipham, Resident Engineer of the North-Eastern Railway Company's Docks at Middlesbrough; Mr. Frederick Anthony White, Gracechurch Street; Mr. Leedham White, Gracechurch Street; Sir Frederick Martin Williams, Bart., M.P., Perranarworthal, Cornwall; Mr. William Lloyd Wise, Adelphi; and Mr. Samuel William Worssam, Chelsea.

The Council reported that, under the provisions of the bye-laws, they had recently transferred Messrs. John George Crosbie-Dawson and George Wilson from the class of Associate to that of Member, and had admitted the following candidates Students of the Institution:—Messrs. George Barclay Bruce, jun., Ernest William Enfield, Mark Helmore, Edward Jennings, Philip Townshend Somerville Large, Robert Edward Peake, and Herbert Perkins Vacher.

There are now on the books of the Institution 14 Honorary Members, 748 Members, 1109 Associates, and 235 Students—together 2106, as against 1995 at the same time last year.

Her Royal Highness the Princess Louise has graciously become Patroness of the Great Marlborough Street Hospital for Diseases of the Skin.

Institution of Naval Architects.—Captain H.R.H. the Duke of Edinburgh, K.G., has signified his intention of becoming a vice-president of this institution.

THE DUKE OF EDINBURGH AND THE LIFE-BOAT SERVICE.

The annual general meeting of the friends and supporters of the Royal National Life-boat Institution was held on Monday, April 8, at the Mansion House, London, by the kind permission of the Right Honourable the Lord Mayor of London. Captain His Royal Highness the Duke of Edinburgh, K.G., R.N., occupied the chair. The meeting was most influentially and numerously attended.

His Royal Highness, in opening the proceedings, addressed the meeting as follows:—My Lord Mayor, my Lords, Ladies, and Gentlemen,—I beg in the first instance to assure you how sensible I am of the honour which has been conferred upon me in being invited to take the chair at the annual meeting of this Life-boat Institution. As a sailor, I must naturally take a great interest in a society which is as national in its character as it is beneficent in its objects. Indeed, the services of an institution of this description cannot be overrated in a great shipping and commercial country like this. I will not anticipate the contents of the annual report which Mr. Lewis will read to you, I will only say that it is a noble record of an institution the like of which can only be found in a country like ours. (Hear, hear.) The society has saved from its commencement nearly 21,000 British and foreign sailors. I may therefore say that it is hardly possible to overrate the value of a society like this, or to estimate rightly the importance of its merciful work, for who can place a value upon human life? Its benign operations are known throughout the civilised world; and the distressed sailor on our shores, whether he be British or foreign, participates alike in the succour which its life-boats are ever ready to afford. The institution has now close upon 240 life-boats under its management, every one of which I am assured is in the most perfect order. It is hardly possible too highly to praise the courage of those men who are always foremost to man these life-boats—(hear, hear)—which rescue every year hundreds of lives which would otherwise perish upon the wrecks. One of these services was rendered a few days ago at Padstow, on the coast of Cornwall, on which occasion the life-boat there, named the *Albert Edward*, after my brother the Prince of Wales, rescued seven shipwrecked persons under the most perilous circumstances. I think I cannot do better than cite this one of the most recent services as an example of the character of these noble performances. It appears that a barque, named the *Viking*, had been driven ashore near Padstow during the gale. The *Albert Edward* life-boat being promptly got to the spot, was launched through a tremendous sea, and, after a great struggle, commenced to take the people off from the bowsprit of the vessel, which was then the only accessible part of the vessel. First of all, the master's infant was lowered in the arms of one of the sailors, and was secured by the life-boat men, but unfortunately the sailor was washed away and was drowned. Then the rope connecting the boat to the vessel was carried away by the severe strain caused by the heavy seas. This happened twice, and on one occasion the boat was driven right ashore by several successive heavy seas, and, although she sustained some damage, the noble boat and gallant crew returned to the charge, and eventually were able to save the captain's wife and five of the crew, who were all landed in safety. These subjects are calculated to rouse our best sympathies on behalf of the Life-boat Institution. (Applause.) It is a society which seems to grow every year in the affections of the British people, on whom it depends for support. It never will, I trust, seek Government help or control. (Hear, hear.) I know that my lamented father was an early patron of the Life-boat Institution, and that it continues to receive the support of the Queen and of the Prince and Princess of Wales. Here in the heart of the City of London this philanthropic institution was first established. Its citizens have in all years been distinguished for their loyalty to the throne, and for their munificence ever displayed on behalf of the cause of religion, charity, and philanthropy. I feel that this noble institution will never appeal in vain either to them or the British public generally, for it is deserving in an eminent degree of their liberal support and sympathy. (Cheers.)

Richard Lewis, Esq., secretary to the institution, then read the annual report.

The report commenced by saying that the Committee of the Royal National Life-boat Institution, in presenting their annual statement to its supporters and to the public, on that, its forty-eighth anniversary, desired to express their grateful thanks to all those who had afforded it their generous aid. They had to congratulate the supporters of the society on the circumstance of Captain the Duke of Edinburgh, R.N., having kindly consented to preside over that meeting, and they tendered to His Royal Highness their warm thanks for the great honour he had thus conferred on the institution. During the past year eighteen new life-boats had been placed on the coast; some of them at new stations, and others replaced worn-out or inferior boats. New transporting-carriages and boat-houses had likewise been provided for several of those boats. The institution had 233 life-boats on the coasts of the United Kingdom and in the Channel Islands. During the past year those boats saved the lives of 658 persons, nearly the whole of them having been rescued under circumstances of peril that would have precluded any ordinary boats from proceeding to their aid. In addition to those services, no fewer than thirty-one ships were saved by the life-boats. It was indeed gratifying to know that the life-boat services of the year had been characterised by their usual gallantry, and, happily, without the loss of a single life amongst their brave crews; which circumstance instinctively excited gratitude to Him whom the winds and sea obey. The storms of the past year in the seas of the British Isles had fortunately not been characterised by any fearful shipwrecks attended with great loss of life. Towards the latter end of the year, however, the gales on our coasts became unusually frequent and violent. Between the 6th and 22nd December the crews of the life-boats of the institution distinguished themselves much in saving 146 lives from various shipwrecks. The efforts of the Board of Trade also continued unceasing in the maintenance and extension of the rocket life-saving apparatus on the coasts of the United Kingdom. The total number of shipwrecks on the coasts of the United Kingdom in 1871 was 1574, accompanied by the loss of 626 lives. In the same period the institution contributed altogether to the rescue of 882 lives; of these 658 owed their lives immediately to the life-boats, and for saving the remainder the institution granted rewards to the crews of shore-boats and other persons, in acknowledgment of their laudable exertions. Thus during the past year the society had granted as rewards nineteen silver medals and votes of thanks inscribed on vellum, besides £2302 in money. Since the formation of the society, it had expended on life-boat establishments, and other means for saving life from shipwreck, £290,000, and voted 91 gold and 826 silver medals for saving life, besides pecuniary rewards to the amount of £36,673. The number of lives saved during the forty-eight years, from the establishment of the institution in 1824 to the end of the year 1871, either by its life-boats or by special exertions for which it had granted rewards, was 20,746. Words failed adequately to delineate the blessings that had flowed to countless numbers of families—apart from those actually saved—by the preservation of so large a number of persons from shipwreck. Happily the life-boat work is now an established fact—and it is certain to be undertaken, with the highest probability of success, on every occasion of storm and danger. The Committee cordially acknowledged the prompt and cordial co-operation of the Lords Commissioners of the Admiralty, the Board of Trade, the officers and men of the Coast Guard Service, and the Local Branch Committees and their honorary secretaries. The receipts of the institution during the year 1871 had been £28,140 4s. 3d., and the expenditure, including liabilities, £29,421 1s. 8d. Many gratifying donations since the last report were gratefully acknowledged. Various legacies had also recently been bequeathed to the institution. The items of receipt and expenditure were detailed in the financial statement annexed to the report, audited as usual by Mr. Lovelock, public accountant. It was a source of considerable satisfaction to the Committee to report so favourable and encouraging a state of the finances of the society. Still, looking not only to the vicissitudes of the future, but to the certain annual expenditure required for the maintenance of every life-boat it possessed, it was manifest that the committee must not for one moment relax their efforts to enlist the continued co-operation and pecuniary assistance of the British public; as that alone, under God, could secure the permanent efficiency of the important work which they had undertaken to carry out and to superintend.

The report having been moved and unanimously adopted, resolutions in furtherance of the objects of the institution, and expressing thanks to His Royal Highness the Duke of Edinburgh and the Right Honourable the Lord Mayor of London for their co-operation in connection with the meeting, were proposed and seconded by Admiral Sir George Sartorius, K.C.B; Admiral Sir John Hay, Bart.; The Right Hon. the Lord Mayor; Sheriff Sir John Bennett; Sir James Elphinstone, Bart.; Captain Lord Garlies, M.P.; Sir T. Edwards Moss, Bart.; Rev. G. F. Prescott, M.A.; Thomas Chapman, Esq., F.R.S.; Sir Edward Perrott, Bart.; and Admiral Sir W. H. Hall, K.C.B.

H R.H. the Duke of Edinburgh, in responding to the vote of thanks to himself, said he was much gratified with the kind manner in which his name had been received. The pleasure had been entirely on his side, for it had been a very great pleasure to him to render any service to such an institution. They must all have been impressed with the excellence of the report. A remark which fell from Mr. Chapman would also be impressed upon them; it was as to the efficiency of the life-boats which were used in the service, for he stated that not a single life had been lost out of any of the boats during the last three years (hear, hear). With regard to the resolution calling upon the public for support, he thought they ought especially to thank the ladies for their attendance, and for the interest they manifested in the welfare of the institution, for they could not have better advocates in any work of philanthropy than the ladies. (Cheers.) The proceedings then terminated.

MUSICAL SOUNDING-BOARDS.

Mr. Robert Smith, of the firm of Parker and Smith, piano manufacturers, Plymouth, read a paper before the members of the Plymouth Institution, on "Musical Sounding-boards as Conservators of Energy" (*vis viva*), during which he brought under notice a transverse laminated sounding-board for pianofortes—an important invention which he has just patented. Dr. Hingston, the President, explained that Mr. Smith offered to read the paper at an ordinary Thursday night meeting, but the rules of the institution were most stringent, confining those meetings to lecturing members; but the institution being desirous of promoting everything scientific, and Mr. Smith's invention being eminently scientific as well as practical, the institution was very glad to fix a special meeting that he might bring its characteristics before them.

Mr. Smith's paper was far more interesting than its title would imply, and was appropriately illustrated. After explaining the value

of bringing all that was connected with manufactures to the test of science, he characterised his subject as an amphibious one, existing with one leg in Science and the other in Art. The construction of musical sounding-boards was at present empirical, but he believed that all the phenomena connected with it was capable of satisfactory explanation. The cause of the sensation of sound was discussed, and an experiment showed that the agency of air was not necessary to it. The nature of the pleasure derived from musical instruments was next touched on, particularly the pleasure derived from them as conservators of force or energy, and it was shown by reference to toys and other articles that a similar pleasure would be appreciated by other senses than that of hearing. The general effect of sounding-boards was next dwelt on, and it was proved that a board might be theoretically correct, but that in actual practice this very perfection gave rise to certain defects. The qualities of different kinds of wood of sounding-boards were discussed, and reasons were given why some were found unsuitable. The fact that wood possesses three unequal axes of elasticity and sonorous conduction was dwelt on at considerable length, and explanation was given of the phenomenon. Analagous phenomena regarding the refraction and reflection of light in passing through media of different refractive indices were spoken of. A large lens was shown which was quite useless on account of striæ, and it was shown that the passage of sound through substances of different densities is governed by the same laws.

Special interest was given to the lecture by the exhibition of several old Italian violins, the property of Dr. Codd, of Devonport, who had kindly lent them for the purpose of showing the beautiful "silver grain" or "clash" apparent on the sounding-boards. One of these was a genuine Stradivarius in a perfect state of preservation—a magnificent instrument valued at £700.

At the conclusion of the lecture Mr S. Weekes tested a pianoforte manufactured by Messrs. Parker and Smith, fitted with the lecturer's patent sounding-board. Its tone was very rich and sweet, and the instrument sang beautifully—the special characteristic of the new sounding-board.

Dr. Hearder, in opening the discussion, said there could be but one opinion as to the competency of the lecturer and as to the success of the effect he had thrown into his instrument.

The Rev. T. W. Freckelton was not certain whether two pieces together would vibrate the same as a single piece, and would not, under certain conditions, act independently; and as the whole of the piano vibrated, did not the quality depend quite as much on the kind of wood in the case and how it was put together as on the sounding-board?

The Lecturer said the two boards glued together would vibrate exactly the same, and that the vibration of the other parts of the piano was so small compared with the sounding-board as not to be appreciated. The closer the vibration was confined to the sounding-board the purer was the tone.

The Rev. F. E. Anthony thought, practically, the success of the lecturer's plan had been proved.

The Lecturer, in answer to Mr Weekes, said the tone of a piano depended not so much on the sounding-board, but on the number of harmonies introduced.

The President, at the conclusion, expressed the thanks of the institution to Mr. Smith for his able lecture.—*From the Western Daily Mercury.*

SKELTON'S IMPROVEMENTS IN LAMPS FOR STREET LIGHTING.

Want of space compels us to postpone the insertion of an illustrated description of this important invention, whereby our roadways and pavements will receive the benefit of the full illuminating power of the street lamps, instead of its being dissipated in attempted illumination of the tops of the houses.

(*Reviews of Books, continued from page 72.*)

Modern Science and the Bible: Their positive and direct antagonism. The paramount authority of Divine revelation, and the inevitable discomfiture of all that is opposed to it. Supported by extracts from a series of letters, notes, and memoranda (philosophical and critical). Originally published in the year 1817, in refutation of some of the opinions broached by the late Thomas Chalmers, D.D., of Edinburgh, in his "Discourses on the Christian Revelation." Collated and abridged by the Editor, and dedicated to the bishops, clergy, and religious professors generally throughout the world. London: Robert Banks, 30, Ludgate Hill. 1872

"Save us from our friends" is well illustrated in the present work for of a surety the position of the Bible as a "lamp to the feet and light unto the path" is by it reduced to a mere laughing-stock for all reasonable minds. With the author of this work the mere apparent literal statements are everything, and the great and deep thoughts thereby conveyed are secondary and subsidiary. One piece of advice we should like to get into the minds of such men is this—that the Bible needs not their efforts to maintain its true authority and character. "God is His own interpreter—He will make it plain."

Natural History of the Year. By the late Bernard Bolingbroke Woodward, B.A., Librarian to Her Majesty the Queen. Revised Edition. London S. W. Partridge and Co., Paternoster Row.

This is a handsomely bound pocket work full of pleasant reading on the subject of the natural history of this country, arranged according to the order of the seasons. It is a work well fitted for the instruction of youth in that subject. Moreover, it is one of those books in which religious and moral instruction is made ancillary to its ostensible object. We can confidently recommend it as a family table-book.

Gutch's Literary and Scientific Almanac for the Year 1872. London Virtue and Co., Publishers, 26, Ivy Lane, Paternoster Row.

The present number of this well-known annual is fully equal to any of its predecessors. It contains the calendar and other information usually given in almanacs and pocket books, and also a number of ably written articles on various scientific and technical subjects.

New Theory of the Figure of the Earth, considered as a Solid of Revolution; founded on the direct Employment of the Centrifugal Force, instead of the common principles of Attraction and variable Density. By William Ogilby, Esq., M.A. Trin. Coll. Camb., Fellow of the Geological and Zoological Societies of London and Dublin Member of the Royal Irish Academy, etc., etc. London Longmans, Green, and Co. 1872.

The following statements in the preface to this work will afford a full *exposé* of Mr. Ogilby's views:—

"The theory of the figure of the earth is, perhaps, better adapted than any other problem of physical sciences, without even excepting the theory of the tides (the acknowledged reproach of applied mathematics), to exhibit the abuses of the analytical treatment here referred to, and the fallacy of their results. Any unprejudiced person of average intelligence, and moderate acquaintance with the principles of the mathematical and physical sciences, and the *rationale* of their respective processes, must be impressed with the incongruity of confounding their appropriate modes of reasoning, or of subjecting the properties of concrete matter to the doctrine of abstract relations. Yet there is no more common fallacy in applied mechanics, nor any that has given occasion for the introduction of so much false logic and so many arbitrary hypotheses. This question of the figure of the earth for instance, the first and greatest problem of terrestrial mechanics, is never pretended to be treated according to physical principles, nor even solved by direct mathematical demonstration, but made to depend on a collateral proposition, and inferred as a corollary from the statical equilibrium of the surface, *itself assumed in the first place to be an ellipsoid of revolution*. This assumption that the earth is a pure ellipsoid, formed by the revolution of a geometrical ellipse about its minor axis, is the grand fundamental mistake which necessitates all the subsequent hypotheses and vitiates all the final results. It is, in fact, beginning at the wrong end, and controverting the whole scheme of the Inductive Philosophy, to assume an hypothesis in the first place from which to lead down to phenomena; instead of recognising existing facts, as known by observation and experience—in the present instance, the solid heterogeneous structure and spheroidal figure of the earth—and from these admitted phenomena reasoning up to their cause. The demonstration, if such it can be called, is thus reduced to a palpable *petitio principii*, a glaring instance of reasoning in a circle, in which the spheroidicity is *presupposed* for the purpose of proving the equilibrium, and the equilibrium *afterwards* employed to prove the spheroidicity. A sophism which would prove fatal to any other argument, is not even noticed by mathematicians, and Laplace contents himself with admitting the incongruity as an unavoidable necessity. 'The figures of the heavenly bodies,' says he, 'depend on the law of gravity at their surfaces, and as this gravity is the resultant of the attractions of all their particles, it must also depend on their figures: therefore the law of gravity at the surface of the heavenly bodies and their figures have a mutual connection which renders the knowledge of the one necessary for the determination of the other. In consequence of this, the investigation becomes very difficult, and seems to require an analysis specially adapted to the subject.'

Now, the whole difficulty here admitted, and the complicated and fruitless analysis to which it leads, arise from the arbitrary and groundless assumption that the figures of the heavenly bodies depend on the law of gravity at their surfaces, whereas it is universally known and acknowledged that these figures are produced by the centrifugal force developed about their axes of rotation, and that the variation of gravity, instead of being the cause, is in reality an effect of the change of figure. The whole question is thus argued on a false issue, and avowedly treated as if the figure were the effect of an attraction varying *inversely* as the square of the distance, instead of a phenomenon of simple gravity varying *directly* as the square of the sine of the latitude. What wonder that such erroneous treatment, conducted throughout on purely analytical principles, should be attended with unusual complications, and require the aid of many arbitrary hypotheses to adapt its results to the circumstances of the problem; or that these results themselves should be uncertain or fallacious, when a simple physical problem is reduced to a question of abstract algebraical symbols."

(*To be continued in our next.*)

The Inventors' Patent Right Association, Limited.—This now well-known and ably conducted Association, the prospectus of which appears in the advertising columns, is, as may be seen from the list of recorded specifications, transacting a large patent business. Its organisation for obtaining patents combines so great economy in the charges with sterling efficiency, and its arrangements are so complete for unravelling disputed questions of patent-right, that it is gratifying to find former predictions as to its success fully borne out by the results. Members of the Inventors' Institute, to whom, moreover, it affords special advantages for obtaining and maintaining patent-rights, largely avail themselves of the services of the Association.

(*Continued from page 66.*)

Machines for rolling metal. (Complete Specification.)—783. S. H. Hodges. Machinery for trimming or burnishing the soles or both soles and heels of boots or shoes.—784. W. R. Lake. Apparatus for producing and utilising artificial waterfalls for propelling vessels and operating machinery (com.)—785. C. W. Harrison and A. H. Harrison. Heating and cooking by gas.

On 11th March.—736. C. de Negri, G. Herrmann, and W. Guest. Machinery for the manufacture of hat bodies, sacks, bags, hose pipe, and various other articles.—737. F. H. Ocles. Dentists' busts employed in the display of artificial teeth.—738. G. W. Wigner and J. Williamson. Mechanism applicable to dry closets and commodes.—739. J. Dove. Metallic heel for boots and shoes.—740. S. Moorhouse and W. J. Kendall. Apparatus for communicating between guard and driver and passengers on railways. 741. F. Cooper. Finishing velvets and velveteens.—742. J. B. Denton and R. Field. Regulating intermittent filtration of sewage and irrigation, and in apparatus for that purpose.—743. W. H. May. Stoppers for bottles and jars.—744. W. Gray. Boilers.—745. A. Strauss. Apparatus for indicating the height of bilge water in ships and vessels (com.)—746. W. J. Curtis. Permanent way of railways and tramways, and of the carriages to run thereon.—747. E. F. R. Lucas. Coking of pitch, and in the manufacture of solid hydrocarbons therefrom.—748. F. D. Sargent. Cornice poles and roller window blinds to be used either in combination therewith or separately.—749. A. Browne. Machine for sewing gloves (com.)

On 12th March.—750. J. H. Johnson. Machinery or apparatus for separating or sorting various substances (com.) 751. W. Rose. Treating waste boiler plates and other similar plates for the manufacture of gun-barrels and nail-rods.—752. E. Wattoou. Explosive compounds (com.)—753. S. Gibson and J. Gibson. Sowing machines.—754. J. Simpson. New or improved device for protecting growing celery and cardoons.—755. S. Barton. Rose and nozzle or jet to be used in connection with syringes and other apparatus for distributing water.—756. W. L. Anderson. Improved mode of fastening gaiters, leggings, and other articles, and in the fastenings employed therefor. 757. A. M. Clark. Changing the shuttles in looms (com.)—758. R. A. Browne. Utensil for poaching eggs and other culinary purposes.—759. W. A. Smith. Purse glove.—760. W. R. Lake. Manufacture of boots and shoes, and in apparatus therefor (com.)

On 13th March.—761. S. Deards. Apparatus for heating water for warming conservatories and other buildings.—762. A. M. Clark. Improved battery gun (com.) (Complete Specification.)—763. T. Bradford. Means of heating cylindrical or other surfaces used for mangling, calendering, or ironing textile or other fabrics.—764. W. R. Lake. Machinery employed in the manufacture of leather (com.)—765. C. W. Heaton and E. H. Francis. Apparatus for filtering oil and other liquids.

On 14th March.—766. S. J. Beaman and J. Onions. Puddling furnace.—767. A. Schanschieff. Apparatus for facilitating telegraphic signalling upon railways (com.)—768. T. J. Smith. Apparatus for the production of gases for heating and other purposes (com.)—769. A. Schanschieff. Apparatus for receiving telegraphic signals and despatches (com.)—770. W. R. Lake. Apparatus for preventing injury to railway carriages by the displacement or removal of the rails, the slipping of the wheels therefrom, or other like accidents (com.) (Complete Specification.)—771. S. G. Gregg and D. Evans. Method of forming the surfaces of roads, railways, footpaths, platforms, and other roadways, which improvements are applicable to the construction of bridges, pillars, and other buildings.—772. J. Bavin. Steam engines and in generating steam. 773. W. R. Lake. Roll for spinning machines (com.)—774. W. J. Lockyer. Preparation of artificial manures.—775. W. Palliser. Boots and shoes.—776. J. Somerville. Gas retort lids and mouthpieces, and machinery for luting the same.—777. E. Edwards. Dial-plates for calendar clocks and watches (com.) (Complete Specification.)—778. W. G. James. Construction of traps for drains.—779. J. C. Mewburn. Safety thermometer or alarm apparatus for steam boilers and other purposes (com.)—780. A. M. Clark. Safety boat-lowering and detaching apparatus (com.)—781. H. B. Barlow. Manufacture of healds for weaving and in heald shafts (partly a com.)—782. Sir J. Whitworth, Bart. Wheels to run on railroads and common roads.—783. W. R. Lake. Electric torch for lighting gas (com.) (Complete Specification.)—784. E. Kaulbach. Means of obtaining parallel motion, and of converting curvilinear into direct rectilinear motion.—785. J. Collinge. Reaping and mowing machines.—786. W. R. Lake. Boot and shoe heels (com.)—787. A. Longsdon. Ships or vessels of war, and in forts, batteries, and other armed or military structures or apparatus for use on sea and land.

On 15th March.—788. M. P. and C. H. Payne. Brick-making machines and apparatus connected therewith.—789. J. Kincaid. Permanent way of tramways.—790. R. A. Robertson. Evaporating liquids, and in the apparatus to be employed therein.—791. P. Jensen. Boring through earth or other soil by means of water pressure, and in apparatus therefor (com.) 792. R. Clachar. Presses for pressing cotton and other fibrous substances into bales (com.) 793. F. S. Thomas. Materials for making roads, ways, and floors.—794. J. Russell and W. R. Hutton. Obtaining zinc.—795. W. E. Thomas and E. Taylor. Method of and apparatus for fixing rollers on to the axles of wringing, mangling, and other machines.—796. J. Warburton. Cork fastener and apparatus or machinery for making the same.

On 16th March. 797. J. Barnett and W. Vokins. Economisation of fuels and prevention of incrustation in boilers.—798. J. Barnett and W. Vokins. Furnaces.—799. M. Benson. Washing, cleansing, and purifying petroleum and other kinds of oil, and in the apparatus for performing the same (com.) (Complete Specification.)—800. E. Laporte and C. D. Fontaine. Preparation of tobacco.—801. F. W. Gerhard and J. Light, jun. Production of iron and steel. 802. M. Benson. Brine skators and evaporating pans and apparatus, and the mode of constructing the furnaces for the same (com.) 803. W. Crighton, W. W. Crighton, and S. Crighton. Converting reciprocating into rotatory motion, or for producing intermittent rotatory motion suitable to be used in the feeding of machinery employed in the preparation of cotton and other fibrous materials, and for various other purposes. 804. L. A. Brode and J. Brode. New compound for substituting wood, millboard, and other similar materials.—805. J. H. Lock. Bed tables and book supports for invalids and others.

On 18th March.—806. J. Farran. Fancy weaving.—807. D. Graham, jun. Electric bell apparatus. 808. C. Furlong. Files for holding papers.—809. I. L. Pulvermacher. Electro-conducting and electro-generating apparatus or appliances for medico-electric and other purposes.—810. E. A. Desbordes. Folding hand or other cart or carriage.—811. H. Phillips. Dry closets.—812. E. Gibou, L. Dusart, and C. Bardy. Converting starch and other feculent and cellulose substances into saccharine matter or gum.—813. S. Neville. Lears for annealing glass.—814. C. Jackson. Shuttles for sewing machines.—815. F. Johnson and W. Hatchman. Manufacture of fabrics for umbrellas.—816. C. J. Temple and R. S. Danter. Union joint or coupling for hose and other pipes (com.)

On 19th March.—817. G. H. C. Hedley. Fire-lighter.—818. R. Gorga. A synoptic system and characters employed therein for the more easy learning of the pronunciation of English and foreign languages.—819. G. Pashley. Valve for hydraulic and other purposes.—820. F. Feldtmann. Apparatus for heating and ventilating railway passenger carriages (com.)—821. M. A. Soul. Balloon locomotive or navigable balloon (com.)—822. C. Dumbleton. Apparatus for cutting or forming screw threads upon wood, metal, and other material.—823. S. E. Holten. Mechanical writing instruments, applicable for reporting and other purposes (com.)—824. W. Marshall. Clog bottoms.—825. J. Copeland. Valve to be used for regulating and stopping the supply of steam, water, air, gas, or other fluids.—826. W. Garey. Preparing paper for photographic purposes.—827. J. H. Johnson. Compositions to be used in fireworks and for signalling purposes (com.)—828. W. R. Lake. Printing telegraphs (com.)—829. W. R. Lake. Printing telegraphs (com.)—830. W. R. Lake. Apparatus for raising, retaining, and lowering boats (com.)—831. A. P. Smith and C. Ribbans. Non-conducting compositions for coating steam-pipes and boilers, applicable also for preventing the passage of heat or cold to or from pipes, refrigerators, or other vessels.—832. C. A. McEvoy. Connecting electric cables and conductors.—833. J. Molesworth. Manufacture of elastic gusset webs.—834. P. J. Ekman. Construction of window sashes and frames.—835. N. Prada. Preserving animal substances, and in agents for the purpose (partly a com.)—836. D. Nicoll. Compounds for and in the treatment of fabrics to render the same waterproof and uninflammable.—837. R. Monteith. Process for preserving animal and vegetable substances (com.)—838. A. M. Clark. Compound for cleaning, restoring, and preserving carpets, rugs, and similar fabrics (com.)

On 20th March.—839. R. Howson and J. J. Thomas. Revolving puddling furnaces.—840. F. R. Window. Method of taking silhouette or outline pictures.—841. J. Rawcliffe, jun., W. Bibby, and A. Fleming. Spinning mules.—842. R. Smith. Sounding-boards for pianofortes and other stringed musical instruments.—843. H. G. Sievier. Umbrellas and parasols, and in the machinery to be employed therein.—844. J. D. H. T. Decamps. Suspensory apparatus for raising and supporting the sick or wounded, and others.—845. W. Whyte, jun. Improvements in boilers to be used in treating or bleaching paper-making materials and textile materials and fabrics.—846. F. Lebacq. Shoeing horses by a system of fluted iron to prevent the contraction of the foot.—847. J. J. Bleckly. Rolling iron, steel, or other metal bars into wire rods, hoops, or small sections.—848. U. A. Lanteigne. Machinery for ornamenting, engraving, embossing, or sculpturing wood or other material.—849. H. Y. D. Scott. Treatment of sewage water.—850. G. Little. Machines for combing cotton and other fibrous materials. 851. J. A. Jaques and J. T. Oakley. Machinery for grinding, surfacing, drilling, or otherwise working articles made of iron or steel.—852. E. Malhere. Machinery for the manufacture of lace.—853. R. Spence and E. J. Spence. Machinery for the manufacture of bricks from plastic clay.

On 21st March. 854. W. E. Newton. Breech-loading ordnance (com.)—855. W. R. Lake. Machines for attaching covers to pamphlets (com.)—856. W. R. Lake. Machines for setting and securing lacing hooks in leather, cloth, or other materials (com.)—857. W. R. Lake. Ovens, chiefly designed for baking bread, biscuits, and other like articles (com.)—858. W. Carr. Spindles and shuttles.—859. J. Hopkinson, elder, and J. Hopkinson. Construction of street lamps.—860. A. Budenberg. Pulley blocks (com.)—861. J. Rice. Apparatus for propelling vessels.—862. J. Jefferson, C. Jefferson, L. Jefferson, and M. Jefferson. Machinery for combing wool and other fibres.—863. W. Benson. Machinery or apparatus for cutting coal.—864. W. R. Lake. Button-hole sewing machines (com.)—865. J. Werner. Composition to be used as a substitute for "brewers' pitch" for lining vats, casks, and tubs, and for other like purposes.

On 22nd March.—866. H. G. Cardozo and A. W. Taylor. Method of and apparatus for facilitating the payment and preventing the fraudulent appropriation of the fares of passengers travelling in tramway cars, omnibuses, public vehicles, or other conveyances, also applicable to public bars, restaurants, or other places where a check on payments is desirable.—867. W. A. Lyttle. Poles for telegraphic and other purposes.—868. J. Young. Apparatus employed in the manufacture of the carbonates of soda and potash.—869. E. T. Hughes. Mechanical movements for converting motion (com.)—870. A. C. Stevenson. Glass and other reverberatory furnaces.—871. H. B. Barlow. Looms for weaving (com.)—872. H. Adlam. Stays.—873. J. Gillies. Machinery and apparatus for making moulds for casting certain articles in metals.—874. J. S. Brown. Raising or lifting liquids, and apparatus therefor.—875. A. V. Newton. Converting a reciprocating into a rotary motion (com.)—876. J. Lewis. Joining or connecting the parts of the head, foot, and side rails of metallic bedsteads and cots, and metallic railing for various purposes, which improvements are also applicable to the connecting of metallic ornaments

to articles of metallic furniture.—877. F. Ransome. Artificial stone (partly com).—878. P. M. Parsons. Ordnance and carriages, and projectiles for the same.—879. J. Milroy and J. W. Butler. Coffer-dams.—880. H. Hollefreund. Treatment of potatoes, maize, corn, millet, and other starch-containing vegetable matters to obtain saccharine and other products therefrom, and in the apparatus employed therein.—881. W. S. Brolly. Combination locks, and in mechanism connected therewith (com.)—882. L. A. M. Helie. Holding or bottling and drawing off cider (com.)

On 23rd March.—883. J. B. Muschamp. Liquid meter.—884. I. Pickard. Machinery or apparatus for transmitting motion to sewing machines.—885. C. W. King. Regulating the speed of marine engines and apparatus therefor.—886. C Owen. Prevention of accidents in railway tunnels.—887. E. A. Cowper. Regenerative hot-blast stoves for heating air, steam, and other gases.—888. W. Darlow. Portable magnets for curative and other purposes.—889. J. Howard and E. T. Bousfield. Ploughs and other tilling implements.—890. R. M. Letchford and W. B. Nation. Treatment of paraffine.—891 T. Giles Safety valves—892. W. Walton. Lever spring lock sash fastener—893. W. H. Baxter. Machinery or apparatus for weighing or measuring corn and other substances—894. J. F. Allen. Steam generators. (Complete Specification.)—895 W. R. Lake. Cartridge for fire-arms (com.) (Complete Specification.)—896. W. R. Lake. Apparatus for mounting and working ordnance (com.)—897. W. R Lake. Apparatus for mounting and working ordnance (com.)

On 25th March—898. F G. Brewer Studs or buttons (com)—899 W. Garton. Brewing.—900. W. R Lake. Fire-extinguishing apparatus (com) (Complete Specification.)—901 A. M. Clark. Joints for the lids or covers of gas retorts (com) (Complete Specification)—902. A. M. Clark. Elevating apparatus for firemens', builders', and other purposes (com)—903. W. R Lake. Supplying and using steam for driving street-railway carriages and other vehicles (com)—904. G. Little and T. C. Eastwood Preparing and combing wool, cotton, and other fibrous materials.—905. J Howard and E. T. Bousfield Steam boilers.—906. W. Neill. Valves of cylinders used in forcing air.—907. Z Shrimpton. Manufacture of crochet and netting needles, pen-holders, hair-pins, and other similar articles—908. G. J. Snelus Lining for cupola furnaces, also applicable to the formation of the beds of reverberatory furnaces—909 W. R. Lake. Composition bearings for the journals of axles, shafts, or spindles (com)

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On 6th April—1020. E. Feldtmann. Universal mandril (com.)—1021. W. N. Nicholson.

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On 11th April.—1064. W. R. Lake. Sieves (com.)—1065. L. A. Badin. Deodorising human excrementitious matters, and of its manufacture into farm manure suitable for all descriptions of agricultural purposes and to all localities.—1066. S. C. Reed. Portable stretchers and bedsteads for military and other purposes.—1067. F. Render. Reins for riding and driving.—1068. G. Winram. Spring mattresses and seatings.—1069. J. Worrall and J. Kershaw. Apparatus for scouring pile fabrics.—1070. J. Worrall and J. Kershaw. Finishing cotton cords.—1071. J. Heberlein. Apparatus for working brakes in railway trains.—1072. W. Cullen. Apparatus for grinding grain.—1073. J. Bell, jun., and T. Bell. Apparatus for discharging horizontal retorts.—1074. H. Ashworth. Spinning and doubling cotton and other fibrous substances.—1075. G. Luttringhaus. Machinery or apparatus for cutting out metal plates to pattern.—1076. J. H. Johnson. Preparing linen thread for dyeing (com.)—1077. J. H. Johnson. Rotatory steam-engines (com.)—1078. H. A. Bonneville. Machines for spinning wool, cotton, silk, and other fibrous materials (com.) (Complete Specification.)—1079. H. A. Bonneville. Painting the surfaces of woven jute, alone or combined with flax, hemp, and cotton, in imitation of paintings well-known as tapestry of the Gobelins or of Beauvais (com.) (Complete Specification.)—1080. J. J. Bodmer. Manufacture of iron and steel.

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* "Com." means "Invention communicated from abroad."

Construction of walls, ceilings, and floors of buildings and other structures -1150. S. Sorby and J. C. Richardson. Multiple furrow ploughs. —1151. J. L. Norton. Manufacture of blocks and slabs for building, paving, and such like purposes

On 18th April – 1152. S. Crighton. Apparatus for regulating the feeding of machinery employed in the preparation of cotton and other fibrous materials (Complete Specification.)—1153. C. Jackson. Sewing apparatus.—1154. W. B. Robins. Hand pumps or syringes.—1155. E. F. Goransson. Apparatus for obtaining motive power.—1156. O. Holcroft and J. F. Lackersteen. Apparatus for separating metals from their ores or other admixtures.—1157. T. C. Fidler. Construction of suspension bridges and iron arches.—1158. J. Brod. Apparatus for lighting and heating.—1159. C. Catlow. Looms for weaving.—1160. S. Brooke. Carding engines.—1161. B. Graham. Apparatus for preparing wool or other fibrous substances for feeding carding engines.—1162. H. Warry. Beverages

On 19th April.—1163. H. A. Dufrené. Process for the preservation of textile fabrics from the destructive effects of wet or moisture (com.)—1164. E. Griffiths. Steam ships or vessels, and in screw propellers.—1165. J. Davey. Turnwrest ploughs, parts of which improvements are also applicable to steam ploughs.—1166. P. Roston. Emptying or exhausting the conduit or supply pipes of cisterns and similar structures as a protection from frost or other damage.—1167. J. Campbell. Mode of getting at the external bottom of ships and vessels for the purpose of cleaning, repairing, and overhauling them.—1168. G. Bailey. Machinery for winding yarn.—1169. G. L. Shorland. Grate backs for increasing the efficiency of steam-registers and other fire-grates.—1170. J. Lage. Boilers or steam generators.—1171. J. Barrow and C. J. Crosfield. Utilising certain saccharine syrups, and in apparatus employed therein.—1172. R. Ramsden. Steam boilers.—1173. S. Kay and T. Kay. Feeding bottles, parts of which are applicable to other purposes.—1174. R. Wilson. Hydraulic machinery or apparatus.—1175. W. R. Lake. Machine for filling metallic boot heel shells with wood or other materials (com.)—1176. W. R. Lake. Treating animal and vegetable fats or greases for the purpose of obtaining stearine and oleine therefrom (com.)—1177. J. Hawker. Steam road locomotive or traction engines, parts of which are applicable to portable engines.—1178. T. J. Smith. Jacquard machinery (com.)—1179. M. Rowlands. Coke ovens, and in the means of charging the same

On 20th April.—1180. F. G. Fleury and A. Tyler. Water waste preventors, or apparatus for controlling and arresting the flow of liquids.—1181. A. E. Bacon. Case for railway and other tickets, fitted with a memorandum paper or advertisement sheet (com.)—1182. H. Bythoway. Annealing boxes, pots, or pans, used in tin works.—1183. C. H. Aston. Connection with spiral spring mattresses and frames, and spiral springs used in connection with frames, bedsteads, couches, and for other upholstery purposes.—1184. H. C. Briggs and D. R. Ramsay. Steam generating and heating apparatus to be used in connection with rotary or other puddling furnaces.—1185. W. D. Scott. Governors for motive power engines.—1186. G. Davies. Construction of stereopticons (com.)—1187. A. McGregor. Construction of machinery for reaping and mowing.—1188. R. Shaw. Drawing frames used in the preparation of cotton and other fibrous materials.—1189. M. Doublet. Means and apparatus for the transmission and registration of telegraphic despatches (com.)—1190. J. H. Teal. Controlling, regulating, and shifting the packing of pistons working in cylinders, as in steam, air, and water engines, air and water pumps, and other machines, while the same are in motion.—1191. N. P. Stockwell. Embroidery and tuck-marker attachment for sewing machines (com.)—1192. W. B. Thelwall. Construction and method of actuating colossal and other figures of men, monsters, and animals for stage purposes.—1193. E. J. Hill and J. L. Clark. Boat-lowering apparatus.—1194. S. H. Stevens and T. Williams. Machinery for reducing tin stuff and other partially pulverized ores and substances.

On 22nd April.—1195. W. W. Ladelle. Automatic pulp save-all.—1196. J. Pickles. In

(Continued on page 95.)

The Scientific Review.

JUNE 1, 1872.

REPORT OF THE COMMITTEE OF THE HOUSE OF COMMONS ON THE PATENT LAWS.

In occupying this page of the Scientific Review with the following Report, which has been agreed upon by the Committee of the House of Commons on Letters Patent, we warn our readers that it requires to be carefully considered with due regard to surrounding circumstances; for though the recommendations are many of them quite in accord with the suggestions from time to time made in this journal, and adopted by the Inventors' Institute, they have, it appears to us, been distorted in order to favour the views of those persons who, finding themselves unable to obtain the abolition of the Patent Laws, are determined, if possible, to emasculate them by adopting a system of inquiry into the frivolity or importance of inventions sought to be patented: that is to say, it is evident to us that the Report recommends not that our Patent system be Americanised, but that it be Prussianised. Moreover, no recommendation is made on the vital point of cheapening the cost of Patents:—

Your Committee have continued the investigation commenced last session into the law, practice, and effect of grants of letters patent, and after a careful consideration of the evidence on the respective branches of the inquiry given by eminent lawyers, patent agents, inventors, and manufacturers of this and other countries, have arrived at the conclusions contained in the following resolutions:—

1. That the privilege conferred by letters patent promotes the progress of manufactures, by causing many important inventions to be introduced and developed more rapidly than would otherwise be the case.

2. That the same privilege leads to the introduction and publication of numerous improvements, each of a minor character, but the sum of which contributes greatly to the progress of industry.

3. That in the absence of the protection of letters patent, the competition of manufacturers among themselves would, doubtless, lead to the introduction of improved processes and machinery, but that it would probably be less rapid than under the stimulus of a Patent Law.

4. That it does not appear that the granting of pecuniary rewards could be substituted, with advantage to the public interest, for the temporary privilege conferred by letters patent.

5. That the existing Patent Law of this country and its administration are in many respects defective, and require considerable improvements in the interests of the public, of manufacturers, and of inventors.

6. That protection for a limited period, and dating back to the time at which it is applied for, should only be granted for an invention on its nature and particular points of novelty being clearly described in a provisional specification, and upon the report of a competent authority that such invention, so far as can be ascertained by such authority, is new, and is a manufacture within the meaning of the law.

7. That letters patent ought not to be granted for any invention so protected until the provisional specification has been open to inspection, nor until a complete specification has been deposited fully describing the means of carrying it into effect, and such complete specification has been found by the same authority to accord in all essential particulars with the description of the invention in the provisional specification.

8. That all letters patent should be subject to the condition that the manufacture shall be carried on within the United Kingdom, so as fully to supply the demand for the same on reasonable terms to the public, and with due regard to existing interests.

9. That letters patent shall not be valid for an invention which has been in use in a foreign country, unless a patent for the same shall have been granted in such country, and unless such letters patent shall have been granted in this country to the original inventor, his assignee, or authorised agent.

10. That the duties payable on patents should be so adjusted as to encourage inventors to the utmost to make known their inventions, and that their primary application should be to the purposes of a complete and well-organised record of industrial progress, and to an improved establishment for the conduct of patent business.

11. That no person concerned in the administration of the Patent Law should have a pecuniary interest in the number of patents applied for, granted, or refused.

12. That inasmuch as the property created by the Patent Law, and the questions arising under it, are peculiar, the tribunal for deciding contentious matters in reference thereto should, both as to its constitution and procedure, be adapted to those peculiarities.

13. That the present condition of the Patent Commission is open to serious complaints.

14. That the Patent Law Amendment Act of 1852 provided that the Commission should consist of certain *ex officio* Commissioners—viz., the Lord Chancellor, the Master of the Rolls, and the Law Officers of the Crown for England, Scotland, and Ireland, together with other persons to be appointed by the Crown, but no such other persons have ever been appointed.

15. That the Lord Chancellor, the Master of the Rolls, and the two English Law Officers are now the only Commissioners, and by reason of their other engagements it is very difficult to get a meeting of the Commissioners, and practically an officer in the Patent Office does the duty of the Commission.

16. That the law and its administration are defective:—

(*a*.) They admit of protection, and, subsequently, of a patent being granted for an invention which is not properly the subject of letters patent, not being a manufacture, or being a manufacture is not new, and of patents being granted for the same invention to several contemporaneous applicants.

(*b*.) They offer no guarantee against patents being used solely or chiefly for the purpose of obstruction.

(*c*.) The facilities afforded to an intending patentee for ascertaining whether his invention is new are insufficient.

(*d*.) The time, trouble, and expense involved in proceedings affecting the rights of patentees and of the public are excessive.

17. That the following alterations of the law and of its administration are desirable:—

(*a*.) That protection be not granted to any invention except on the report of a competent person or persons that the conditions of Resolution 6, as to such protection, are fulfilled.

(*b*.) That no warrant for sealing letters patent be issued until the conditions of Resolution 7 are fulfilled.

(*c*.) That in the case of several concurrent applications for a patent for the same invention, the patent be granted to the first applicant, unless it be shown to the satisfaction of the proper authority that he is not the first inventor.

(*d*.) That all trials of patent causes should be before a Judge, with the assistance of skilled advisers (who may be Commissioners of Patents), and, as a rule, without a jury; but with power for the Court to order a jury for the ascertainment of facts in exceptional cases requiring the same.

(*e*.) That the Commissioners be reinforced by the appointment of competent persons of legal, scientific, and technical experience, whose time is not occupied with other engagements to such an extent as to prevent their giving full attention to such administration.

(*f*.) That the Commissioners should make rules, relegating to some of their body, together with competent assistants, among other duties, that of ascertaining as to every invention for which a patent is sought to be obtained whether it is properly the subject-matter of a patent, whether its nature and the particular points of novelty have been clearly described in a provisional specification, and whether so far as can be ascertained by them it is a new invention; and, as to the complete specification, whether it fully describes the means of carrying the invention into effect, and accords in all essential particulars with the description thereof in the provisional specification.

(*g*.) That all letters patent should contain the following conditions not hitherto usually inserted therein, viz., that the manufacture be carried into effective operation within a reasonable time, within the United Kingdom by the patentee or his licensees, so as to supply the demand therefore on reasonable terms; and that the licences be granted by him to competent persons on fair conditions, as well as the fact of competency, to be determined in the event of disagreement by the Commissioners, due regard being had in such determination to the exigencies of foreign competition.

(*h*.) That besides the assistance afforded to intending patentees by the examination of their specifications, and by the reference library of the Patent Office, more satisfactory indices and abridgments of specifications be provided, and more particularly that the practice of accepting, without control or revision, the abridgments prepared by the patentees themselves be abandoned.

(*i*.) That the Court or Judges, having discretion in patent litigation, should avail themselves of the assistance of the Commissioners for the better definition and limitation of the matters in dispute in respect of particulars of breaches and of objections respectively.

(*j*.) That in all future appointments of officers concerned in the administration of the Patent Law remuneration by fees should (as it has been in the recent appointment of Her Majesty's Solicitor-General) be discontinued.

18. That suitable provision should be made by Parliament for the remuneration of the Commissioners who do not act *ex officio*.

19. That this Committee are of opinion that there should be an assimilation in the law and practice in regard to inventions among the various civilised countries of the world, and that Her Majesty's Government be requested to inquire of foreign and colonial Governments how far they are ready to concur in international arrangements in relation thereto.

Reviews.

A Sketch of various Plans which have been proposed as a Means to effect Puddling by Machinery; the Causes of Failure Pointed Out, and the Probable Solution of the Difficulty Suggested. By WILLIAM YATES. With Appendix. London. Vacher and Sons, 29, Parliament Street. (Re-issue 1872.)

THIS pamphlet refers to the question of puddling iron by machinery, now claimed by Mr. Danks as his invention; which, however, Mr. Yates says was invented by Mr. W. H. Tooth and himself, and submitted to the iron trade many years ago. We will enable our readers to judge for themselves by presenting them with Mr. Yates' account of the matter:—

In 1853 a patent was taken out by Messrs. Walker and Warren, and it is thus described in the Abridgment of Specifications relating to the Manufacture of Iron and Steel, published in 1858 by the Commissioners of Patents:—

"A.D. 1853, May 18. No. 1223. Walker, Bernard Peard, and Warren, James. 'Improvements in the Manufacture of Iron.' The iron is melted in an ordinary blast furnace, and conveyed in a fluid state to the improved puddling furnace of the patentees This consists of a fire-grate of an ordinary construction, with which is connected a movable or revolving hearth, or 'containing vessel,' made of iron lined with brick, or of other suitable material. This hearth is made to rotate by any convenient means, and is inclined at an angle to its rotation. It is surrounded with a cast-iron casing. The melted metal being introduced into the revolving hearth, it is there agitated, and so puddled without the aid of hand labour. The hearth is heated by the flames from the fire, or waste products of combustion from the blast furnace, which are admitted between the revolving hearth and the casing, and are carried off by the chimney. The iron may, if necessary, be melted in the puddling furnace."

Before commenting hereon, I may mention that Mr. Tooth, whose name will appear further on in this narrative, has related to me some details of experiments made by him on mechanical puddling furnaces, and which are confirmed by the corroborative evidence of Mr. Benton, now of Vauxhall Gas Works, who assisted him in his endeavours; but not having arranged for an outlet of the charge, they gave up Tooth's then plan, to be revived with improvements, as we shall see, a few years later on.

Returning to Walker's and Warren's patent. It will be seen that the furnace is formed *with a sloping hearth*, which is made to rotate by any convenient means, and *is inclined at an angle to its axis of rotation*. By this arrangement only *so small a space is left for the charge, that an operation, which requires to be done by hundredweights, can only be done by pounds*; and to enlarge the furnace to a commensurate size would render it not only unwieldy, but by an increase in the diameter of the containing vessel, would cause the charge to be so far below the flame as to prevent the efficient action of the heat on the metal under treatment, and *this slope is insisted upon as "essential" even in their application to disclaim certain irrelevant portions of their first patent, dated December*, 1864. The only mode of discharge from their furnace is through, or rather across, the flue betwixt the furnace and the chimney, which might do for puddled balls of a few pounds weight, such as only could be produced by their machine, but would be useless and next to *impracticable as an outlet for puddled balls* of a size suitable to iron-making in earnest and for business purposes.

I assign the foregoing as the reasons why the apparatus of Messrs. Walker and Warren has not proved a useful invention.

Next was a patent taken out by Mr. Anthony Bessemer, dated 5th October, 1858. As the Commissioners of Patents issued the abridgment above alluded to in 1858, as Mr. Bessemer's patent was only taken out towards the end of that year, no description is given in that publication. Mr. Bessemer supplies very complete drawings and descriptions of the means he proposes for puddling iron, and which were more likely to succeed than those of Messrs. Walker and Warren; nevertheless it appears evident to me that Mr. Bessemer *could only have intended to produced refined iron*, as he speaks throughout his entire specifications of *discharging by "pouring"*—an expression which implies *fluidity. Iron, when it has reached a puddled state, has lost its fluidity*, and becomes a granular and consistent mass.

Next in order is W. H. Tooth's patent, dated 2nd February, 1860, which adopts a good deal of Walker and Warren's and Bessemer's plans, and carries the process one important step forward by rendering it possible to extract useful-sized puddled balls from the furnace through the opening by which the flame from the fire-box enters *the revolving cylinder, or puddling furnace proper*, and by means of the contrivance of shunting away the fire-box, and using a pair of tongs attached to a small *crane rigged up on the frame of the furnace*, and thus extracting the charge as puddled iron in the form of roughly-shaped balls ready to be sent to the forge hammer or squeezers.

I now appear on the scene as having assisted W. H. Tooth in practically demonstrating his apparatus.

A model furnace, with Mr. Tooth's invention applied thereto, was erected at Stepney, and worked experimentally off and on for several months, and reported on by Mr. Frederick Braithwaite, C.E.

That gentleman's report, dated 21st May, 1861, states that the mechanical arrangements of the machine (Tooth's) he considered "practically complete, simple, and good, and that the new system, even under all the disadvantages of a first experiment, consumed only 11 cwt. 1 qr. of coal to the ton of puddled balls, as against, say, 16 c. 17 cwt of coal to the ton by the old method.

"I consider that one experienced puddler, with three unskilled labourers, would attend to six of your furnaces, against six upper and six under hands required now to attend to six ordinary puddling furnaces, and by dispensing with the use of the 'fettle,' a further saving of 3s per ton is effected, as well as a good deal in puddler's tools.

"With respect to the lining of the furnace, I have estimated that, with suitable material, it would last two weeks at a cost of £1 15s.

"I was informed that the 'Churn' was originally intended for a 4 cwt. charge, but in practice it was found more convenient to work only charges of 3 cwt. With an additional length to the cylinder of, say 18 inches, a 4 cwt. charge could have been puddled with nearly the same quantity of fuel used for the 3 cwt. charge: and I arrive at this conclusion from the great length of flame passing into the body and through the outlet of the furnace.

"I cannot refrain from remarking that, however favourable these results are, they would have been much more so had we not had to contend with such serious disadvantages, that our performances were very aptly designated by an experienced ironmaster, 'Making iron under difficulties.'

"What with the exposed situation, the want of covering for the apparatus, and the protection of the men from the roughness and cold of February and March, the unfavourable setting of the boiler, with ill-constructed, tortuous flues, the insufficiency of the draught, and the want of steam-power, it is indeed very surprising that I am able to render such a favourable account.

"You will be pleased to learn that we had many experienced and scientific gentlemen to witness the experiments, all of whom expressed themselves as quite satisfied.

"You will observe on examining the records of the day's work, there is a most marked difference in the number of charges. This arose partly from atmospheric influence, the chimney drawing better on some days than others, from the greater dampness or dryness of the flues (the boiler being set below the level of the canal, close adjoining), and more especially from the various qualities of the iron and coal operated on; this could not have been otherwise in a trial of this kind to test the powers of the machine for puddling any kind of iron presented to it. In one instance some rubbish was puddled in two hours which I think could scarcely have been brought into puddled iron by hand labour.

"However, the last few uninterrupted days' working show a marked improvement over the first days of the trial, when the whole process was new to the men.

"As your 'Churn' under all the above disadvantages has satisfactorily demonstrated such valuable improvements, I strongly recommend the erection of a suitable work with all necessary appurtenances, for I feel confident that, under proper supervision and with properly adapted materials, the favourable results I have recorded will be more than confirmed.

"Some of the balls puddled as above have been hammered and rolled into bars of excellent quality."

Whilst the lining of the furnace was new and the fire-bricks remained hard and sound, the iron produced was of very good quality, but so soon as the fire-bricks became sodden with heat and soft, the earthy matter mixed with the metal under operation, produced silicate of iron, and rendered the puddled balls tender and difficult to hammer, and the bars inferior.

Mr. Menelaus, of Dowlais, who had seen on the 26th January, 1861, the puddling machine in operation at Stepney, sent some of his practical men also to see it, and from their reports, confirming his own views, that puddling by machinery was practicable, some trials were instituted at the Dowlais Works; but there, as with us in our small attempts, the lining, viz., of fire-bricks, proved the weak point, and, in consequence, puddling by machinery was allowed to rest, but to be revived when Mr. Menelaus can find leisure to attend to it.

All patents for the machines above alluded to have been allowed to lapse.

Mr. Braithwaite's report, as well as the following extracts of papers and other documents, will show that it was acknowledged that "Churns," or rotating puddling furnaces, *have proved mechanically successful*; the adoption of them, though so much desired by the ironmasters, was compelled nevertheless to remain in abeyance *until a suitable lining could be found*

I now append, what I hope and feel pretty sanguine will be, a solution of the difficulty of effecting puddling by machinery, and proceed to describe the lining, for which I obtained a patent, No. 1939, 13th June, 1868, and which, I trust, will supersede fire-bricks or fire resisting stoves in rotating puddling machines and for Bessemer converting vessels.

In various metallurgic operations and smelting processes it has been shown in practice that fire-bricks and fire-stones are not perfect as the lining materials for furnaces and other vessels used in the treatment of molten metals, and especially is this proved to be the case with respect to Bessemer converting vessels, and in rotating puddling machines, where, as soon as the fire-bricks or fire-stones begin to soften, particles of the earthy or grit of the stony matter of which they are composed are worn or rubbed off, and combining with the metal under treatment deteriorate its quality and lessen its worth.

I substituted for fire-bricks or fire-stones *iron* (titanic iron ore and similar fire-withstanding materials are literally specified by me, and with these Danks has succeeded) *in a condition sufficiently fire-resisting to be economical in use, and which, even when abraded or fused off, being a homogeneous matter, will*

not be injurious, as a heterodox compound would be, to immature iron or steel.

I consider the merit of my *ferruginous substance* to be, that it is adapted for the linings of most kinds of furnaces, and is to be applied and used when suitable in preference to fire-bricks and fire-stones; but most particularly so for mechanical puddling machines and Bessemer vessels; even in some instances it might be adopted *not only for the lining*, but also for the casing of a furnace or vessel. I therefore claim the application and use of a METALLIC substance, as more fully described hereafter, either for forming the outer or inner, or other parts, or for a combined use of it for both the outer and inner parts, or otherwise in furnaces, &c. And I claim as "my improvement in furnaces and the linings of furnaces" the application and use of a metallic fire-resisting substance, which may be made of CAST IRON, but this is not recommended—(Spiegel Eisen is however best, as it contains chemically-combined manganese, which imparts strong fire-resisting properties)—MALLEABLE CAST IRON: MALLEABLE IRON or PUDDLED STEEL, both of which may be either in a rolled or hammered form. STEEL, cast, rolled, forged or tilted; and all of these substances may be of any suitable form, whether as blocks—solid or hollow—bricks—solid or perforated—rings—either in one piece or cylinder, or of more pieces—bars or staves, both of these latter, when intended for the lining of rotating puddling machines or Bessemer converting furnaces should be wedge-shaped to accommodate themselves to the form of such vessels.

I prefer, when possible, that the *iron lining* should, as much as practicable, be impregnated, saturated, or imbued with manganese, for the reason stated above, but on this I do not absolutely insist.

The importance of success in this matter may be seen by contemplating the following figures:—

		Tons
MALLEABLE IRON manufactured annually in Great Britain .		2,000,000
	Tons	
America . . .	3,000,000	
France and Belgium.	3,500,000	
Germany, all States .	4,000,000	15,000,000
Russia . . .	2,500,000	
East Indies . .	1,000,000	
Sweden and Norway	1,000,000	

As regards the make of Malleable Iron in foreign countries, I have endeavoured to ascertain its extent, and the foregoing figures have been given me, but I cannot guarantee their correctness, and can only give the statement for what it is worth. I confess it appears to me greatly exaggerated. If, however, we assume the total make of this and foreign countries to be 10,000,000 tons, we shall be perhaps within the mark.

Estimated saving by mechanical puddling over the cost by the ordinary method—

	£	s.	d.
Less waste of iron, 2 cwts. at 60s. per ton	0	6	0
Less consumption of coal, 6 to 5 cwts., 6s. per ton . . .	0	1	6
Wages. 9s. per ton now, would be 3s. per ton	0	6	0
Repairs of furnace, fettle, and tools, say 5s., reduced to 1s. 6d. .	0	3	6
Saving of time about one-sixth, say	0	3	0
	£1	0	0

For safety, say 10s. per ton.

This requires verification by an extended trial on a large scale in an established and well-appointed iron work, for which I require co-operation and assistance, viz.—

The partial use of a small portion of an ironwork to practically put into operation an invention which it is hoped will completely conquer the last difficulty in puddling by machinery. The expense of demonstrating and proving the plan at an ironwork, with forge and mills, could hardly exceed £100.

Also the opportunity of testing a lining for Bessemer converting vessels which will not abrade and deteriorate the metal. Cost of this trial might be £25.

(To be continued.)

Spectrum Analysis in its Application to Terrestrial Substances, and the Physical Constitution of the Heavenly Bodies. Familiarly explained by Dr. H. SCHELLEN, Director der Realschule, I. O. Cologne, &c. Translated from the second enlarged and revised German Edition, by Jane and Caroline Lassell, edited with notes by William Huggins, LL.D., D.C.L., F.R.S. With numerous woodcuts, coloured plates, and Angstrom's and Kirchhoff's maps. London: Longmans, Green, & Co. 1872.

THIS is a translation of Schellen's interesting and instructive work, founded on lectures delivered by him during the winter of 1869, before the "Vereine für wissenschaftliche Vorlesungen," at Cologne. Its object is not only to give a clear and familiar representation of the nature and phenomena of spectrum analysis, enabling an educated person not previously familiar with physical science to become acquainted with the newest and most brilliant discovery of this century, but also to show the important position which spectrum analysis has acquired in the pursuit of physics, chemistry, technology, physiology, and astronomy, as well as its adaptability to almost every kind of scientific investigation.

To facilitate the due appreciation of the results which have been obtained by the application of spectrum analysis to the heavenly bodies, with each class of objects a summary of the information hitherto furnished by the telescope is given, and a glance in passing at the progressive development and partial transformation of the heavenly bodies has been sought to be conveyed.

The author expresses his grateful thanks for the valuable assistance rendered him by various scientific men who have kindly communicated to him the results of their labours, among whom he would especially mention Messrs. Huggins, Secchi, Lockyer, Zöllner, Janssen, Morton, and Young.

The work contains full information on all matters connected with spectrum analysis.

Thus in Part I. the luminous power of flame, the Bunsen burner, the magnesium light, the oxyhydrogen flame, Drummond's lime-light, the electric spark, the induction coil, luminosity of gases, Geissler's tubes, the voltaic arc, the electric light, and the electric lamp are fully and familiarly exemplified; and in Part II. spectrum analysis in its application to terrestrial substances is dealt with, whilst in Part III. the subject of spectrum analysis is very closely examined as to its application to the heavenly bodies.

Independent of the information contained in the main body of the work, in one appendix thereto the cause of the interrupted spectra of gases is treated of by G. Johnstone Stoney, M.A., F.R.S., and in another appendix a "preliminary catalogue of the bright lines in the spectrum of the chromosphere," by C. A. Young, Ph.D., Professor of Astronomy in Dartmouth College.

The work is truly one of the most compendious treatises ever written, and the translation does credit to the translators.

Astronomy and Geology Compared. By Lord ORMATHWAITE. London: John Murray, Albemarle Street. 1872.

THIS is another theologico-scientific book—one in which orthodoxy is championed by no less a person than one of the lords of the land.

Lord Ormathwaite has evidently bestowed much thought on the subjects he has discussed in the pages of this work, and has dealt with them in a candid and common-sense way. As, however, we have so recently devoted much space to these controversial questions, we do not feel justified in occupying our journal with what is really a repetition of matter already placed before our readers (see our notice of Dr. Melia's book, pp. 54, 55 of the present volume of the SCIENTIFIC REVIEW). We cannot, however, forbear from quoting the following pertinent remarks on modern progress in Science and the Arts:—

The march of true Science is irresistible; wherever her foot is once planted it can never be withdrawn—she is the mightiest of conquerors. Everything must give way before her, however unwilling or reluctant mankind may be, they have no choice but to follow wherever she has once taken an authoritative lead. Just as bows and arrows have given place to muskets, and Brown Bess to breech-loaders, the old sailing vessels to screw steamers, and the screw steamers to ironclads, so in every other path, whenever it is once clearly and fully illumined by the torch of Science, the human race have no choice but to follow. If fifty years ago any speculative chemist had foretold the possibility that by a combination of chemistry and optics it would become possible to fix the fleeting images and shadows that flit before our eyes and transfer them to paper in shape of durable pictures, he would have been regarded as a dreamer. Yet the art of photography has within that period been diffused over the whole of the civilised world, and in the future has become as imperishable as civilisation itself, with which it is entwined. A still more recent and far grander and more important step in science has been made by the electric telegraph. In the commencement of the present century the wonders it accomplishes would have been considered on a par with the inventions in the "Arabian Nights' Entertainments"; we should have regarded as the most incredible of fictions an assembly in London transmitting a message to Calcutta, and receiving an answer in the course of the same evening before it separated, or the speech of the President of the United States being circulated in London the day after it was delivered. Such apparent miracles would have been ranked with the feat of the African magician removing Aladdin's palace in one night from the centre of Asia to that of Africa. Yet the discovery of the almost instantaneous transmission of the electric fluid once made, and the means devised of utilising it having become a permanent addition to human knowledge, it will be preserved and extended by its own utility. No conceivable revolution in society can ever again wrest it from us, it must remain a permanent addition to the powers of man.

The strongest example, however, which can be adduced of the permanent nature of every solid advance in science may be drawn from the establishment of that solar system from which I have already drawn several illustrations. It would be impossible ever to revert to the erroneous systems of Pythagoras or Ptolemy. The earth can never again be enthroned as the centre of the universe, but must be contented through all time to occupy her assigned place whirling about the vast orb of the sun, to which we bear about the same proportion as a cricket-ball to the dome of St. Paul's.

Speaking of civilisation, Lord Ormathwaite proceeds in a similar strain:—

What is civilisation? When and where did it originate? These are questions which the popular and current acceptation does not satisfy. Civilisation is used in a comparative sense. We are civilised in relation to some other states, which are half-civilised, or not civilised at all. We are civilised now, in contrast with some former period, when we were ourselves uncivilised, and out of which we have emerged. What date shall we assign to that epoch? Shall it be the revival of learning, and the birth of science at the close of the middle ages? Shall it be the Christian era? Shall it be the foundation of the Roman empire, or the Babylonian monarchy? All these are no doubt important stages in the history of man, but when we have reached the remotest, we find that we have not yet attained the zero of civilisation. Let us adopt another test, and try to discover that period in which what we

at present call the arts of civilised life had their origin, antecedent to which man was utterly rude and uncultivated, and from which we have derived nothing, and nothing has descended to us. But such an inquiry will lead us into still darker obscurity. We shall find that not only in science, but that in all our arts, in all the contrivances of human ingenuity with which our modern life is surrounded, whether the most familiar or the most elaborate, what is recent is constantly interwoven with the remote and unknown past All that we can trace is one continued and connected movement, the beginning of which extends far beyond the limits of history, or of tradition, or of any known record. We can only arrive at an approximate guess by examining ourselves, and by endeavouring to discover in what faculties of our nature this great distinguishing characteristic of man is situated.

In illustration of this view, let us take one of the latest, and one of the noblest creations of an advanced civilisation, let us select the *Warrior* man-of-war. How much of human skill, contrivance, invention, and science have been combined to produce that work, how many hands have laboured, how many brains have toiled, how much of art and science, of mechanical ingenuity and skilled labour, have been put in requisition to launch that mighty construction upon the ocean? A legion of miners, iron-founders, ship-builders, carpenters, sail-makers, cordwainers, and artificers of almost every description, have united to frame her. Astronomy has given us the means of ascertaining her place in the trackless ocean. The great discovery of the fifteenth century—the mariner's compass has enabled us to direct her course; the foremost invention of our own times—the motive power of steam—has empowered us to impart resistless velocity to the mighty mass. Armstrong guns, conical shot, all the most recent improvements in artillery, have been enlisted to augment her force as an engine of war Nothing more modern, no better type of progress, could be chosen. But among all these modern inventions, among all these achievements of the sixteenth and succeeding centuries down to our own nineteenth, do we owe nothing to a much earlier epoch, to a date altogether too remote for us to trace its origin?

It would be useless for the compass to point the right direction, or for steam to propel her with untiring speed, if the rudder did not enable the steersman to govern her every movement, and to render all this mighty machine subordinate to his will. The rudder is a tolerably simple contrivance, but it is not altogether an obvious one. Rudders do not come by nature, or grow spontaneously out of the sterns of ships. The first rudder was probably hailed as a great invention, and might have immortalised its author, had there been any means of chronicling inventions. When did he live? What nation did he belong to? How long have vessels been steered by rudders? None of these questions can we answer. All that we know is that the rudder has descended to us from remote ages, and that it is now as necessary to the *Warrior* as either the compass or the steam-engine.

If we push our inquiries farther we shall be able to discover the inventions of a yet higher antiquity, forming a necessary part of the basis on which this wonderful structure has been reared. Of what material are the sides and the armament of the *Warrior* composed? Of iron. And how is that iron ore extracted from the stone in which it is lodged? By the action of fire. How is the steam generated which is her moving force? By the action of fire upon water. The element of fire is one of the primitive constituent parts of the material world; but the power of kindling, managing, directing, and extinguishing fire is an effort of human reason and invention. No animal we ever heard of ever lighted a fire or cooked its own dinner. The use of fire was essential to the construction of the *Warrior*, and when was fire first employed by man? We cannot answer that question

In all that vast floating mass there is scarcely the smallest portion in the state Nature has produced. The raw material she has furnished has been so changed, moulded, and combined with other substances, by the various arts of man's ingenuity, as scarcely to be recognised in its original condition. Human heads have planned, human hands have executed, all the parts of that great machine. The latest inventions of mechanical sciences—the steam-engine and the screw-propeller—contribute their aid to give it velocity When she is launched, how much of science is comprised in that art of navigation, which has been slowly reaching its present advanced stage through centuries of progress? The groundwork of navigation is the science of astronomy, the spheroidal form of the earth, its annual and diurnal motions, the declination of the sun, the relative position of the moon, the apparent angles with the fixed stars, all are essential component parts of that science of navigation so necessary to the direction of the vessel.

I have selected the *Warrior* as a convenient example of the truth of my assertion that civilisation cannot be dated from any known epoch, but that it is the gradual development of the faculties originally implanted in our nature by its Divine Author. There is an advantage in choosing this example, because a vessel like the *Warrior* stands singly. It is a creation in itself. The elements in its formation are thus more easily traced and more distinctly marked than in more complicated results of the intellectual powers of man But every department of knowledge or science, every work of human hands, would afford, if subjected to scrutiny and analysis, similar results. In all it would be manifest that there is no branch of our acquirements or acquisitions which has not sprung from beginnings evidently stamped with the unmistakable character of human invention, but of which all record is lost.

These quotations are fair samples of the contents of the book, which our readers will see is one well worthy of attentive perusal.

Chemical Notes for the Lecture Room

On Heat, Laws of Chemical Combination, and Chemistry of the Non-Metallic Elements. By Thomas Wood, Ph.D, F.C.S., Chemical Lecturer at the Brighton and Lancing Colleges, Author of "Notes on Metals," &c. Third Edition. London Longmans, Green, and Co

This is the third edition of a really useful book—one that a student may resort to, and at once obtain the information he requires, without being wearied by having to wade through hypothetical disquisitions or fanciful theorems.

To the teacher of science the book is still more valuable, for he has here a *vade mecum* which can at any time be used as a remembrancer on any points that may be practically useful in the class-room or lecture-room.

The following notes as to water, with remarks on the tests for its purity, are interesting and instructive —

Water evaporates at all temperatures, and is necessary to both animal and vegetable life. Pure vapour of water is colourless and invisible; the steam and clouds we see contain minute globules of water. Water is capable of dissolving a larger number of substances than any other known liquid, and is consequently never found pure unless artificially prepared.

Gases in water.—Owing to the wonderful capability of water to dissolve other bodies, even the "dew" and fresh "rain"-water contain free gases, dissolved by them from the atmosphere as they fall. Heat can drive out these dissolved gases from the water; *e.g.*, heat a test-tube of cold water and observe the gas bubbles. The sparkling and freshness of water are due to the gases dissolved in it, especially of carbonic (CO_2) and of O gases. The colder the water the more gas it is capable of holding in solution; the warmer it is, the less; on this account warm water and boiled water that has become cold are always flat to the taste.

Softness and Hardness are comparative terms, used to denote the amount of solid impurities dissolved in water, especially of the salts of lime.

1.—*Softness* in water denotes the absence of salts of lime As a rule, the softer the water the purer it is, unless it contain certain kinds of organic matter.

2. *Hardness* in water denotes, especially, the presence of salts of lime. The hardness of a water is commonly estimated by degrees. A degree of hardness in water is equal to 1 grain of lime-salt per gallon. A good water should not contain more than 12 degrees; if a water contain over 20 degrees of hardness it becomes unfit for use Boiling a *hard water* with sodium carbonate (washing soda) precipitates the lime from the water and makes it *soft*.

Distilled water, or condensed steam, is the purest form of water—then rain-water, river-water, spring-water, and lastly sea-water. Sea-water is the *hardest* or most impure of all the waters mentioned above; it contains from 3·5 to 4 per cent. of salts.

Distillation can remove solid matter in solution and all impurities from water which are not volatile or capable of passing over with the steam.

Distilled water is flat and insipid to the taste, because it does not contain any gases dissolved in it To make it fit to drink it must be allowed to trickle through some porous medium, as "bags of charcoal," when it absorbs gases and becomes "aerated" and drinkable

Tests and Impurities of Water.—The principal impurities of water are

Sodium chloride or common salt	$NaCl$
Calcium or lime carbonate, or chalk	CaO, CO_2 or $CaCO_3$
Calcium or lime sulphate, or gypsum	$CaSO_4$

Test for salt—A solution of silver nitrate ($AgNO_3$), produces with salt *a white curdy precipitate* of silver chloride ($AgCl$), *which is insoluble in nitric acid, but soluble in ammonia*.

$$NaCl + AgNO_3 = NaNO_3 + AgCl.$$

Test for chalk or calcium carbonate.—Well boil the water, by which means the carbonic gas *which holds the carbonate in solution* is expelled, the carbonate falling as a whitish powder, called "fur," when deposited in tea-kettles—So a hard chalk-water becomes greatly softened by simply boiling it.

Test for gypsum or calcium sulphate.—There are two tests for calcium sulphate—one for lime and the other for the sulphate.

1st. For *lime* (CaO)—Add a solution of ammonium oxalate, which forms with any lime-salt *a white precipitate* of lime or calcium oxalate, *insoluble in acetic acid*.

2nd For the *sulphate*.—Add a solution of barium chloride ($BaCl_2$), which forms *a white precipitate* of barium sulphate ($BaSO_4$), *insoluble in all acids*:

$$CaSO_4 + BaCl_2 = CaCl_2 + BaSO_4.$$

Soap Test ("Clark's").—It is well known that soap curdles in hard water, and the harder the water the more soap will it curdle. Bergmann in the last century used a spirituous solution of soap to give general indications of the purity of water. Clark's test is a solution of soap in spirits of wine, of such a strength that a given measure of it is exactly curdled by one grain of lime-salt. A measured quantity of water is taken, to which the test-solution is added so long as the water is able to curdle it. From the quantity of test-solution used, the hardness of the water is calculated.

Mineral Waters contain some body dissolved in them which gives them a marked peculiarity: *e.g.*, chalybeate waters contain a salt of iron in solution, whereas Harrogate water contains sulphuretted hydrogen.

Filtration can only remove solid impurities from water, such as sand, mud, &c., and not those which are in solution, as salt. Charcoal can remove offensive smells and organic

colouring-matter from water, on which account it makes a most valuable filter. Filtration, therefore, can never make a *hard* water *soft*, although, if properly performed, it can make an opaque water bright, or a foul water sweet.

Hydrate.—The term hydrate is given to the chemical union of a compound with water; *e.g.*, when caustic lime (CaO) is moistened with water (H_2O), the two combine and form *hydrate of lime* or calcium hydrate (CaO, H_2O or CaH_2O_2), which is a perfectly dry powder.

The following statements as regards carbon are likely to interest many of our readers:—

Carbon occurs in three distinct forms, or allotropic conditions—namely, as *crystalline*, *graphitic*, and *amorphous* carbon.

1. Crystalline carbon, as *diamond.*—Diamonds are found native, and have never been produced artificially. When found colourless and transparent, they are used as jewels; they are, however, frequently yellowish, and sometimes green, blue, black, &c. The crystals of diamond are cubes or octahedrons. The diamond is one of the hardest bodies known; its chief use is for cutting glass. When heated to redness and placed in O gas, it burns and produces carbonic gas (CO_2). The diamond was first proved to be destructible in 1694.

2. Graphitic carbon, as *graphite* (from γράφω, I write.)—Graphite is dug out of the earth in many places, as in Cumberland, Ceylon, America, and Siberia. Graphite was first obtained from Borrowdale, in Cumberland, during the reign of Queen Elizabeth. It is found either massive and misshapen, or in six-sided plates, it has a dark, metallic, lead-grey lustre; hence its name of black-lead, and plumbago (from *plumbum*, lead). It is used for making lead pencils, and when mixed with fire-clay, black-lead crucibles, &c., because graphite cannot be fused, also for giving a black polish to shot and ironware, called "black-leading." Graphite is more difficult to burn in O than diamond, but forms CO_2 when burnt.

3. Amorphous carbon, as *charcoal*, *soot*, &c.

a.—*Wood charcoal* is obtained, either by the slow and partial combustion of the branches of trees, covered with earth, to exclude the air, called "charcoal burning," or by the distillation of wood in red hot iron cylinders. In both cases the H and O contained in the wood, together with some of the carbon, are burnt away or escape, while the greater part of the C remains behind as *charcoal*. Charcoal is not pure carbon, as it retains the ash of the wood; it is usually very porous, and possesses *a remarkable power of absorbing gases*.

Charcoal is used as a disinfectant, or rather deodoriser and purifier, on account of its power to absorb gases and oxidise, that is decompose, nearly all gases possessing an offensive odour. Charcoal is frequently given as a medicine in form of charcoal biscuits and capsules.

b.—*Animal charcoal* is obtained by distilling bones, or by burning any animal matter in a covered crucible to exclude the air. The bones become quite black, from the separation of C contained in the glue or organic part of the bone; and at this stage of their treatment they form the bone-black of commerce, *used by sugar-refiners* and others; they contain, besides charcoal, the solid skeleton of the bone.

To obtain pure animal charcoal, the solid part of the bone must be dissolved out by hydric chloride and the C well washed and dried.

Animal charcoal, like wood or vegetable charcoal, freely absorbs gases, but in addition possesses, in a *remarkable degree, the power of absorbing organic colouring-matter*; *e.g.*, filter port wine or cochineal through animal charcoal, the colour is removed.

c.—*Coke* is the residue left in the retorts after coal has been distilled for the production of coal gas.

d.—*Soot* is condensed smoke, deposited in chimneys; it is used as a manure on account of the ammonia it contains, given out by the burning fuel.

e.—*Lampblack* is obtained by burning bodies rich in C (as impure turpentine) in a limited supply of air, and collecting the C or soot given off. Used in "printers' ink."

Carbon is very abundant; it is contained in all organic matter, and forms therefore part of all animals and vegetables; *e.g.*, the blackening of meat when roasted and of bread when toasted called "burnt" is due to the separation of C by the heat of the fire. When di-hydric sulphate (H_2SO_4) is poured upon sugar, the black mass formed is due to the separation of C from the sugar.

Properties.—A solid, tasteless and inodorous; generally black, friable, and amorphous; is insoluble in all liquids, and can be neither melted nor volatilised (except partially by powerful galvanic currents); it is a bad conductor of heat, but when dense a good conductor of electricity. At the ordinary temperature of the air, it has little affinity for any of the elements, but when heated to redness it can combine with many of them, especially with O: the higher the temperature the greater becomes the affinity of C for O, and it is on this account that heat and C are so often used to remove O from other bodies, especially from the metals.

The air contains O; therefore, when heated, C burns in the air: and if there be a sufficient supply of O, invariably forms CO_2, called carbonic gas, and if there is not a sufficient supply of O a gas called carbonic oxide is formed.

Compounds of C with other elements are called carbides or carburets.

Compounds of carbon with oxygen.

Carbon only forms two compounds with O, viz.—

Carbonic oxide	CO
Carbonic dioxide, called Carbonic gas	CO_2

The combining weight of C is 12. When C is completely burnt it forms CO_2. Now $O_2 = 16 \times 2 = 32$, consequently it will require 32 grms. of O to burn completely 12 grms. of C. Then $32 \div 12 = 2{\cdot}6$, therefore 2·6 grms of O will completely burn 1 gramme of C and form 3·6 grms of CO_2. Again, 32 grms of O will fill 22·4 litres; this measure of O is therefore required to burn 12 grms. of C.

Introduction to the Study of Biology.

By H. Alleyne Nicholson, M.D., D.Sc., &c., Professor of Natural History and Botany in the University College, Toronto, formerly Lecturer on Natural History in the Medical School of Edinburgh, &c., &c. Edinburgh and London: William Blackwood and Sons. 1872.

This book is not a mere ventilator of speculative theories; it is a practical and instructive work, based chiefly upon the introduction to the author's "Manual of Zoology," much of which is given in an unaltered form. A considerable portion, however, of that work has been here recast, whilst fully two-thirds of the work consists of new matter. Illustrations also have been introduced wherever such appeared to be necessary.

Though many important subjects have been necessarily treated very superficially, or altogether omitted as unsuitable for a merely elementary work, yet most of those subjects are touched upon a knowledge of which would be useful to the student of living or extinct forms of life, or to the general reader.

Our justification of these statements will be found in the following interesting disquisition on the elementary chemistry of living beings.

A rough analysis of any living body, whether animal or vegetable, would show that it consists of water, certain organic compounds, and certain inorganic matter. By a gentle heat the water may be expelled, when it would be found that the body experimented on would have lost, speaking generally, from seventy to ninety per cent. of its weight. Living matter, therefore, is very largely made up of water, which, indeed, is an absolute necessity for the performance of all vital actions. After driving off the water, if a strong heat be applied, it would be found that a certain proportion of the dried tissue would be burnt, and would be completely dissipated. In this way we should eliminate a certain quantity of organic compounds, which would differ according to the character of the tissue we were dealing with, and into the nature of which we shall inquire immediately. Lastly, there would remain a small proportion of mineral or inorganic matter which constitutes the "ash," and which would not be dissipated or affected by the incineration. The average amount of ash in animal tissues is about three per cent., but in the case of vegetables the mineral constituents may be present in larger proportions than this.

A living body, then, may be said to consist of water, certain complex organic compounds, and a small proportion of certain mineral or inorganic substances. The presence of all these three constituents appears to be essential to the existence of living matter, and vital action cannot apparently be carried on in the absence of any one of the three. It is to be remembered, however, that though we can make such a rough analysis as the above of the matter of living beings, we know really very little of the mode in which these constituents are combined in the living body. Thus it is uncertain how much of the water is in a state of chemical combination with other constituents of the tissues; and we are still more ignorant of the exact mode in which the mineral or inorganic constituents occur. It is certain, however, that some, at any rate, of the mineral substances are chemically combined with the organic compounds: whilst it is quite certain that both groups of substances are essential to life.

In the following a very brief outline will be given of the more important facts as to the elementary chemistry of animals and plants respectively:—

Chemistry of Animals.—The number of elements which have been recognised in animal bodies is not very large, the chief, if not the only ones, being carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus, chlorine, fluorine, calcium, magnesium, aluminium, potassium, sodium, iron, manganese, copper, and silicon. The first four elements of this list are sometimes spoken of as the "essential elements," as they occur in most tissues; whilst the remainder are very improperly termed the "incidental elements," as occurring only in small quantities and in special tissues. Some, however, of these "incidental elements" are essential constituents of the compounds formed by the so called "essential elements," and most of them are just as necessary to life as the latter are.

Little need be said here as to the occurrence of the so called "incidental elements." Sulphur occurs in albumen, as one of its constituents, and phosphorus is found in nervous matter, and is largely present in bone (as phosphate of lime). Chlorine occurs (as chloride of sodium) in animal juices and in gastric juice (as hydrochloric acid). Fluorine (in the form of fluoride of calcium) occurs in the teeth. Silicon, aluminium, calcium, and magnesium occur in the teeth and bones. Sodium and potassium are found in the blood, and the former is chemically combined with albumen in its soluble state. Iron is found in the colouring-matter of the blood, and, unlike the other metals, is probably present in an uncombined condition. Manganese has been detected in hair, and is also stated to occur in the blood. Lastly, copper is found in the liver and in bile, and in some colouring-matters.

The "essential elements," carbon, hydrogen, oxygen, and nitrogen, occur united with compounds, which, "from their being supposed to stand, in order of simplicity, nearest to the elements," are called proximate principles. In other words, these four elements form a series of compounds which have a definite chemical composition, which may be obtained in an isolated condition from animal and vegetable bodies after death, and which in some cases can be artificially built up out of inorganic materials in the laboratory of the

chemist. The "proximate compounds" of both animals and plants may be divided into two groups, termed non-nitrogenous and nitrogenous, according as they consist of carbon, hydrogen, and oxygen alone, or contain nitrogen in addition to these three elements.

The non-nitrogenous compounds of animals are the various fats. These consist of carbon, hydrogen, and oxygen combined in such proportions that the oxygen would be insufficient to form water with the hydrogen or carbonic acid with the carbon. The exact functions of the fats in the animal economy cannot be said to have been as yet determined in a thoroughly satisfactory manner. Fats occur in most animal tissues and fluids, and in many cases they are certainly not unnecessary or superfluous constituents. There can also be no doubt but that the fats are largely instrumental in maintaining the temperature of the body.

The nitrogenous compounds of animals are numerous, but the three most important are albumen, fibrine, and caseine.

Albumen is a compound of carbon, hydrogen, oxygen, nitrogen, and sulphur, but in its soluble form it is combined with some salt of sodium. In its soluble state albumen is a colourless, tasteless, glairy fluid, which "coagulates" or becomes solid at a temperature of about 150° Fahr., is precipitated by all the mineral acids (except tribasic phosphoric acid), and is not precipitated by any of the vegetable acids (except tannic acid). Albumen is also thrown down from its solutions by alum, corrosive sublimate, sulphate of copper, acetate of lead, creasote, and alcohol. Albumen is found in the blood, and in most of the animal fluids, and also in some tissues; and white of egg is almost wholly composed of it.

Fibrine is very closely allied to albumen, and is best known as occurring in a fluid form in the blood. It also occurs, in a slightly modified state, in muscle. It has the power, when removed from the body, and sometimes whilst still within the body, of spontaneously solidifying or coagulating. When coagulated it is almost undistinguishable chemically from coagulated albumen.

Caseine is an albuminous body which occurs abundantly in milk. It differs from albumen in not being coagulated by heat alone, but in being precipitated from its solutions by acetic acid.

The eminent chemist, Mulder, held the opinion that albumen, fibrine, and caseine, with the similar bodies found in vegetables, are compounds of a substance which he named "proteine" with sulphur and phosphorus. He further believed that "proteine" consisted of the four essential elements, carbon, hydrogen, oxygen, and nitrogen alone. Other good authorities deny the existence of any such base as proteine. Nevertheless, it is a common and often a very convenient practice to speak of the various albuminoid substances of animals or vegetables as "proteids," or "proteine compounds."

CHEMISTRY OF VEGETABLES.—The organic substances which compose the tissues of plants, as in the case of those of animals, may be divided into a non-nitrogenous and a nitrogenous group, according as they consist of carbon, hydrogen, and oxygen alone, or contain nitrogen in addition to these three elements. The chief difference to be noted between animals and vegetables, as regards their chemical composition, concerns the proportion borne by the nitrogenous substances to the non-nitrogenous. In both kingdoms we find "proximate principles" which, if not actually identical, at any rate represent each other; but there is a considerable distinction in the relative amount of the two groups of compounds in a plant as compared with an animal. Animal bodies exhibit a marked predominance of albuminoid or nitrogenous compounds over the fatty or non-nitrogenous compounds. Plants, on the other hand, are mainly composed of non-nitrogenous compounds, and they are, comparatively speaking, poor in albuminous or nitrogenous matter.

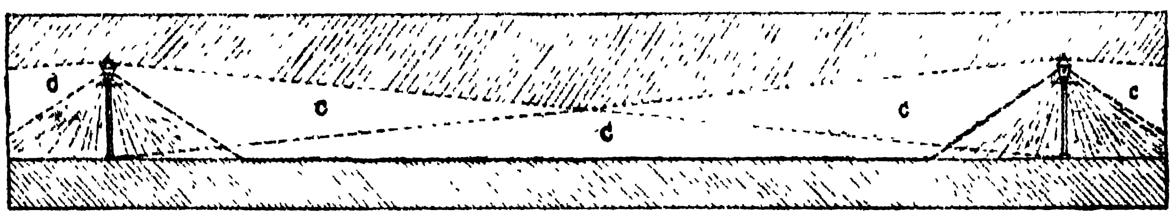
The chief non-nitrogenous principles of plants are starch, cellulose, and sugar, all of which differ from the fatty compounds of animals in the fact that the oxygen is present in sufficient quantity to form water with the hydrogen. Plants, however, are by no means destitute of non nitrogenous substances in which the proportion of oxygen is less than this, or in which, indeed, oxygen is wholly absent.

Starch is composed of carbon, hydrogen, and oxygen, with the formula $C_{12}H_{10}O_{10}$. It occurs plentifully in vegetable tissues, especially in seeds, fruits, stems, and roots; and it is recognised by the addition of iodine, when a blue colour is produced, owing to the formation of a blue iodide of starch. Starch, as such, is not soluble in the fluids of the body, but it is readily rendered soluble by the action of certain bodies of the nature of ferments. Starch is also rendered soluble by the action of prolonged heat, or dilute sulphuric acid, when it is converted into the gummy substance known as "Dextrine" or "British Gum."

Cellulose is largely present in plants, and enters to a great extent into the composition of the cells and vessels of all vegetable tissues. Though allied to starch, it differs from it in some important respects, especially in the fact that it gives no blue colour on the addition of iodine. When cellulose, however, is digested for a short time in sulphuric acid, it is partially converted into starch, as shown by the fact that iodine will then produce the fine blue colour of the iodide of starch. The woody tissue which is deposited in the hard parts of plants, and which is often called "Lignine," may be regarded as probably a modification of cellulose.

Sugar is present in almost all plants, chiefly in their sap. The two most important varieties of vegetable sugar are "cane-sugar" and "grape-sugar," both of which are capable of crystallising.

The nitrogenous compounds of plants need little more than mention, as they do not appear to differ in any essential respect from the albuminous compounds of animals. The most important is "gluten," which occurs abundantly in the seeds of cereals and in the juices of many plants. It is nearly allied to the "fibrine" of animals, and has the power of spontaneously coagulating from its solutions. The juices of many plants also contain a proteine compound which is coagulated by heat, and which appears to be identical with the albumen of animals. Lastly, in the seeds of peas, beans, and other leguminous plants there is found a substance which is termed "legumine," and which appears to be nearly allied to the caseine of milk.



SKELTON'S CATOPTRIC LAMP,

FOR streets, open spaces, railway stations, factories, public buildings, and all situations where the light ascending above the level of the lamp is wasted.

In ordinary street lighting, while there may be sufficient light below or close around each lamp, yet between the lamps there are intervals of comparative darkness; at the same time two-thirds of the light produced from the gas consumed is being lost by upward radiation.

The Catoptric Lamp reflects and utilises these otherwise wasted rays of light, and distributes them so that the intervals between the lamps are evenly illuminated without the dazzling effect producing by ordinary reflectors. See diagram C C C.

In Mr. Skelton's lamps strips of silvered glass are arranged so that the loss of light to the street will be effectually prevented. The upper half of each side of the lamp and the whole of each side of the sloping roof are occupied by a frame in which the strips are placed with their reflecting surfaces downwards, in a manner somewhat analogous to the laths of a Venetian blind. The precise character of the effect produced will depend upon the distance of the strips apart, upon their width, and upon their angle of inclination; but the general result is, subject to small variations, that the street receives three times as much light as would fall upon it through lanterns of the ordinary kind. The frames holding the strips are glazed on both sides, and made dust proof, so that the mirrors will not themselves become soiled or tarnished, and the reflector as a whole can be cleaned in the ordinary way, by simply wiping the glass.

One side of Waterloo Bridge has been lighted by these lamps, the old lamps being retained on the other side for the sake of comparison. The superiority of the light given by the Catoptric Lamp is considered so great that the difference is to be instantly recognised. The fact is that in the old lamp at least one-half the light afforded by the gas flame is wasted so far as the passengers in the streets are concerned. To remedy this, Mr. Skelton fixes at the top of the sides and on the crown of the lamp slips of silvered glass, set at an angle, which reflect the light downward, and distribute it so well, that on Waterloo Bridge it may be said to be possible to read from lamp to lamp.

The inventor and patentee of this lamp is Mr. T. A. Skelton, 37, Essex Street, London, W.C.; Messrs. Messenger and Sons, of London and Birmingham, being the manufacturers.

ROYAL POLYTECHNIC.

THE directors of the Polytechnic, whilst sparing neither pains nor expense in their endeavour to make the institution the most popular place of amusement in London, have not forgotten the scientific department. They have elected Professor E. V. Gardner, F.E.S., a gentleman well known for many years past as an experienced chemist, Professor of Chemistry to the institution; and under his direction the large and commodious laboratory is being entirely re-fitted and re-stocked, and will shortly be opened for the reception of pupils, and for conducting analyses, assays, and scientific investigations of every description.

Some of our readers may possibly remember that Professor E. V. Gardner conducted the School of Science of the old Royal Polytechnic Institution, and that with great success, both as regards the public performance of the pupils and as a financial undertaking. We have no doubt the present arrangements will be equally successful.

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To Correspondents.—SCIENTIFIC COMMUNICATIONS AND BOOKS FOR REVIEW to be addressed to the EDITOR; letters respecting ADVERTISEMENTS, SUBSCRIPTIONS, &c., to the PUBLISHER.—Correspondents are desired to keep copies of their communications as the Editor cannot undertake to return them.

THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON.

ESTABLISHED 1st MAY, 1862

Past Presidents

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868.
LORD RICHARD GROSVENOR, M.P.

Chairman of the Council

SIR ANTONIO BRADY

MEETINGS DURING THE PRESENT MONTH.

THURSDAY, JUNE 6TH.—Conference on the Report of the Committee of House of Commons on the Patent Laws.

At the Meeting on 23rd May, Mr. F. H. VARLEY, F.R.A.S., Member of the Council of the Inventors' Institute, read a paper "On Inventions relating to Telegraphy." The Chair was taken by Capt. J. A. SELWYN, R.N. The Paper and the Discussion on it will appear in our next number.

R. MARSDEN LATHAM, *Secretary*

Members whose subscriptions are now due will please to forward the same to the Collector, Mr. O. A. Stretton, 4, St. Martin's Place, Trafalgar Square, London.

Monthly Notices.

The Claims of Mr. W. H. Tooth, Mr. W. Yates, and Mr. Danks to the Invention of Mechanical Puddling.—A new Sheriff for London interested in Inventive Progress and Technical Education.—Professor Palmieri's Lecture on the Eruption of Vesuvius.—British Trade in Foreign Metals.

WE last month promised to lay before our readers an exposé of the claims of Mr. W. H. Tooth to the invention which Mr. Danks now claims as his own. This we have been to some extent enabled to do in a review, given in another column, of a pamphlet first issued some years ago, and now re-issued, by our correspondent, Mr. William Yates, a gentleman of great practical experience in iron manufacture, who has likewise handed to us a letter he addressed to Mr. Henry Bessemer, as President of the Iron and Steel Institute, restating his claims with still greater precision than he has done in his pamphlet; and it certainly does appear to us from all that has come to our knowledge that a strict investigation ought to be made into the relative claims of Mr. Tooth, Mr. Yates, and Mr. Danks, before the latter gentleman is decided to be the originator of the process of mechanical puddling, which he has doubtless practically applied with so much success. We know full well that too often does the pioneer in applied science get all the uphill work, and is remunerated by his "trouble for his pains"; but we hope that in this case the iron trade and the public will see that impartial justice is meted out, and that every one gets his own. For our part we shall do our best to bring about a consummation so devoutly to be wished.

We notice with much pleasure that the present candidate for the important office of Sheriff of London is Mr. Brooke, of the firm of Simpson & Co., well known as the manufacturers and introducers of the aniline dyes. It is not often that men engaged in promoting the progress of applied science are candidates for civic honours, and, as he appears to be in all respects a man worthy to hold public office of high position, we trust he will succeed in his candidature (though we have little doubt of it), and we venture to hope that he will see it to be to his honour and credit to assist the movement which some time ago was introduced to notice at various City meetings by Mr. F. W. Campin, Mr. J. Jones, Mr. G. Saywell, and Mr. J. R. Taylor, for the establishment of a comprehensive system of Technical Education by the City Guilds. We are the more hopeful of a good issue in this matter from the fact that Mr. Lawley, who is an influential member of the Common Council, is a chief supporter of Mr. Brooke. We have no doubt that great good might be done by the City moving in this direction, and that those who bestir themselves in it cannot fail to win honour and renown by so doing.

Professor Palmieri has been lecturing at Naples on the recent eruption of Vesuvius, the progress of which, with so much energy and ability, he has been watching and investigating for some time past. Amongst the points introduced to public notice by the Professor we may mention the fact that since 1852 the lava ejected from the volcano has filled up the Fosso della Vetrana to the height of 200 metres. The Professor specially noted a remarkable and novel phenomenon—the formation of small craters by the lava, which thundered like the principal crater, and ejected smoke, ashes, and stones to the height of 70 or 80 metres. This fact will, doubtless, much assist in the scientific investigation of the cause of operations in the interior of the volcano. It appears the agriculturists of the neighbourhood of the mountain consider that the ashes benefit the land when applied as manure, though they injure and sterilise it if water be added. The analysis of the ashes shows that a portion is insoluble in water, being a species of silicate; the remaining portion, however, is soluble in water, and contains chloric and sulphuric acids, and salmarina—this burns the land and withers the vegetation.

Many interesting and important facts (says the *Times*) appear in the returns for the first four months of the year concerning our trade in foreign metals. We have imported 16,844 tons of copper ore, contrasted with 15,188 in the corresponding period of 1871, and 14,979 tons in the previous year. Spain has sent pretty nearly the same quantity as in 1871; Chili a tenth of the quantity furnished in 1870; Australia one-third of last year's supply; while "other countries" twice the quantity of last year. To the end of April our *regulus* imports were nearly the same as for the same period in the two previous years. Partly-wrought copper has reached us in nearly double the quantity it did two years ago—namely, 14,819 tons, contrasted with 6,584 tons. Of ingots, cakes, or slabs we have sent away during the four months 78,602 cwt., or 8297 cwt. more than in the corresponding term of last year. France has had twice as much as in 1871.

The Inventors' Institute.

AT the meeting on the 9th of May, Mr. Adutt read a paper on new inventions for preserving grain and corn from mildew, heating, &c., invented by Mr. J. M. Joannides. SIR ANTONIO BRADY, Chairman of the Council, presided, and in opening the proceedings remarked that the subject for the evening was one of the highest importance, not only to corn-shippers, granary owners, and farmers, but also to the whole community; for to save from loss any food material was really equivalent to saving human lives. As he felt sure that this was fully appreciated by all present, he need not dwell further upon such a topic, but would at once call the reader of the paper before them.

Mr. ADUTT then read the following paper:—

"Necessity is the mother of invention" is a quotation which has often been used in speaking of patents, and with regard to the patent that I am about to introduce to your valued attention this evening it is undoubtedly certain that the "necessity" for it was the "mother" of it.

In latter times science has progressed so much and in such varied directions, and scientific men have amended existing defects, or contrived inventions to remedy imperfections, that it is surprising to find that for the corn trade nothing has been successfuly done until now to avert the consequences of heat or mildew that occur to cargoes and large stores of corn and seeds, which have up to the present time caused immense losses to shippers and merchants.

The corn lists in our daily commercial newspapers inform us of the damaged state in which foreign corn and seed arrive in this country, and it is my business here to-night to lay before you a proposed remedy. It will, I think, be admitted that a remedy for this having been found, it will be considered well worthy of adoption, not merely because it seeks to protect corn and seed from damaging effects, but also because of its extreme simplicity of construction. It is, therefore, all the more a matter of congratulation and great satisfaction to know that the apparatus which has been invented and will benefit the community has been patented here and launched in the greatest commercial city of the world, and will be, I believe, an honour to this country.

The invention I have referred to is denominated "The A. M. G. & S. P.," and it will be well to observe that the losses I have just spoken of that accrue from the fermentation of corn and seeds during the voyage to this country will be better understood when I inform you that the detoriation in value ranges from ten to as much as fifty per cent. When corn vessels arrive at the ports of call in this country—namely, Falmouth, Queenstown, and Plymouth—it is the custom of the trade that the official reporter goes on board and examines the entire cargo, and sends to the owners a full description of the corn, and a report of its condition in its different positions in the vessel's hold, accompanied by samples of each kind taken from the bulk. The report is afterwards published in the floating cargo list. The result is that when the corn is sold the price is based on the report made upon it, and thus realises considerably below the value of it at the time of shipment.

Viewing the subject from this point, we shall be led to consider how far the provisions for remedying this evil have been supplied in the patent under notice, the details of which I shall presently place before you; but before doing so I wish to press upon you the fact that, although this invention has not until now been introduced to you, it has already had many severe tests applied to it to prove its efficiency, and the results have been completely successful.

It is well known that grain and seed when closely stored become more heated in the centre of the bulk. The "Anti-Mildew" apparatus will entirely prevent this, for it conveys a strong current of purified atmospheric air into the centre of and among the bulk, thus keeping it sweet as well as cool. After grain is taken from vessels and stored in granaries, the work of destruction still goes on, to arrest which—as at present performed a troublesome and expensive operation—complicated machinery or hand-labour is employed to turn over the corn. This the "Anti-Mildew" apparatus entirely dispenses with, as it circulates air in and generally about the corn, no matter how large the quantity. In order to prove this, a practical working of models of the apparatus will be shown presently.

There is an old Spanish proverb which runs—

"Este he meo amigo, que mee nomoe moinho,"

("He is my friend who grinds at my mill"), and I submit that the man who protects corn and keeps it sweet is a greater friend still, for he saves a vexing loss.

The invention I have referred to is one recently patented and specified by Mr. Jean Methodios Joannides, agricultural engineer, and late Greek Consul in Wallachia; and the sole agents and vendors in this country are Messrs. Adutt, Finzi, and Co., 24, Mark Lane, London.

In his specification Mr. J. M. Joannides thus describes his invention:—

"The apparatus consists of a perpendicular cylinder of metal, wood, or other suitable material, with eight (more or less) horizontal cylinders or pipes of like material, all connected with and branching from the perpendicular cylinder. The said cylinders, both perpendicular and horizontal, are perforated with small holes for the circulation of the air, but so as not to allow of the grain or seed passing through. A series of small tubes are laid along the insides of the large ones for the return of the confined air."

Several models illustrative of the nature and objects of the invention were exhibited and explained. One of these models was a box filled with loose corn surrounding the apparatus (which will be found described at page 72 of the SCIENTIFIC REVIEW, May number, 1872). Tobacco smoke was blown in, and issued forth from the exit-pipe and from the top of the corn.

Mr. J. M. HYDE thought that the sponges used would be of questionable value, for he doubted whether they would keep in order. He should fear that they would soon become ineffective. He could testify as to the importance of the object sought to be attained by an invention of this kind; but he could not see the value of the arrangement of a small pipe inside a larger one. In his opinion the outlet should be distinctly separated from the inlet duct, and he would recommend the use of two distinct tubes of equal diameter. To his mind the present arrangement would produce a confusion of the incoming and outgoing currents. However, he hoped to hear the inventor's experiences on the subject.

The CHAIRMAN stated that he hoped the reader of the paper would give his best attention to demonstrating the necessity for two tubes, for he had an impression that one tube for inlet would do, as the heated air would issue from the interstices between the grains or seeds, as it had done in the experiments tried that evening, and that would be sufficient for all practical purposes, though it was possible that in some cases the outlet tube might be of some assistance. There was no doubt that any air-tube arrangement would be more or less effective, and that great national benefit must result from the application of ventilation to corn-ships, granaries, and haystacks. Doubtless the thanks of the meeting were due to the reader of the paper and to Mr. M. Joannides for bringing this matter before the Institute.

Mr. SMARTT said that tubes placed in haystacks would let heated air out; but he did not clearly understand the absolute necessity for a set of return tubes. He believed that the inventor would find that a double-tube arrangement had been proposed before, but he was not prepared to say that the present arrangement would not be found of value. One point, however, he would like to press upon the consideration of the inventor—that was, how is grain to be prevented getting down the tube?

Mr. ADUTT, the CHAIRMAN, and Mr. JOANNIDES explained that there was a curve at the top of the pipe which could be fixed in any suitable position, so as to prevent the entrance of the grain; further, raised valves might be adopted if found desirable.

Mr. F. H. VARLEY explained that by the arrangement of the two tubes in the way described one became upcast and the other downcast, which they all knew was the regular system of mine ventilation; and in the way Mr. Joannides had arranged his pipes an inverted syphon was formed, the effect of which was that the air came in through the one and out through the other. Although it was evident that the air would find its way out through the interstices between the loose grain or corn, yet that alone could not be depended on, hence the arrangement adopted by Mr. Joannides was necessary. He understood he had tried to do without the outlet tube, but found he could not do without it.

Mr. CARTTAR said the commercial value of this invention could not be overrated, and, notwithstanding all that had been urged in opposition to Mr Joannides' invention, he felt great confidence in it.

Mr. W. H. TOOTH knew how difficult it was to keep corn in a dry, healthy state. He had put up arrangements of heated floors to keep the corn dry. He considered the second tube necessary, as if the top of the corn got wet and pasty there would be an obstruction to the exit of the air through it, and then the return tube would operate to keep up the circulation. As a brother inventor he could understand the necessity for making provision for every exigency that might arise. Having himself had considerable experience as an engineer and an inventor, he knew that that was a matter that must not be overlooked. One thing was certain, Mr. Joannides' invention was intended to effect a great and noble object, the cheapening of the food of the people, and they could not thank him too much.

Mr. MACCOMBER remarked that the Ancient Egyptians kept people for turning over grain, as was evident from their hieroglyphics, so the desirableness of taking measures to preserve grain and corn sound and sweet was well established. He thought the invention good as to its objects and as to its main principles, but considered its details might be simplified and improved; but such matters could with confidence be left to time and the good sense of the inventor. In his own country (America) he had known times of abundance and cheapness, when in some places Indian corn had been used as fuel in winter time, it being readier for use than wood, which had to be got from the forests and cut up before it could be used. One of the great desiderata in the United States was the prevention of heating of corn and grain, and he therefore advised Mr. Joannides and Mr. Adutt to take this invention to that country, where he knew it would be well received. To show the importance of this matter to America he would present the meeting with a few statistics:—The United States produced—Indian corn, 1203 millions of bushels; value, 120 million pounds sterling. Wheat, 246 millions of bushels; value, 50 million pounds sterling. Oats, 53 millions of bushels; value, 26 million pounds sterling. The whole, fifteen hundred and two million bushels; value, 196 million pounds sterling, or, 980,000,000 dollars.

Mr. M. M. HARRIS, as a resident for many years in the United States, confirmed Mr. Maccomber's views.

The CHAIRMAN in summing up remarked that, great as was the loss from heat and mildew, the weevil was almost as great a source of loss, and he hoped to have got the inventor of a very ingenious plan for preventing loss from that source to be present this evening. In his absence he would mention that the invention consisted in stirring the corn and grain in air-tight chambers, in abstracting oxygen from the atmosphere, exhausting the air from the chamber, and

passing heated air over spongy corn to produce nitrogen and so prevent the animals living. He had now to close the proceedings by asking a vote of thanks to the reader of the paper, and to Mr. Joannides, the inventor. This was voted with acclamation, and then

Mr. ADUTT returned thanks, stating that in his experience as a merchant he knew that the cargoes of corn and grain arrived in this country more or less damaged by heat and mildew. He might mention one instance, that of a ship having three holds; the after-hold arrived bad, and the cargo was sold upon the bad sample, whereby a loss of £500 was sustained, instead of £500 profit as the shipper expected.

Mr. CAMPIN then asked the meeting to accord a vote of thanks to Sir Antonio Brady, the Chairman of the Council, for presiding at this meeting, and in doing so stated that Sir Antonio, though scarcely recovered from severe indisposition, and much pressed by numerous important engagements, had nevertheless responded to the request of the Institute that he should fill the chair on the present occasion, and he knew they would all feel as he did, that the business of the evening would have lost much of its valuable effect if they had not had his help.

Mr. J. M. HYDE seconded this motion, which was carried with much applause.

Before the meeting separated Mr. W. H. TOOTH exhibited several different forms of construction of breech-loading guns, which various members present stated they considered very practical and valuable.

ON THE NEW SOUTH DOCK IN THE ISLE OF DOGS, FORMING PART OF THE WEST INDIA DOCKS, BY MR. L. F. VERNON-HARCOURT, M.A., M. INST. C.E.

THE works referred to in this communication were constructed on the site of the City Canal, the timber pond, and adjacent land. They comprised a dock of 26¼ acres, joined to a basin of 5¾ acres by a passage with reverse gates. The western entrance to the canal from the river Thames was retained, but at the eastern extremity a new entrance had been formed leading from the basin to the river. On the south side of the dock foundations for five warehouses had been prepared, and the superstructure erected on three of them, with a quay shed in front. The main dock was 2650 feet in length, 450 feet in breadth, and had quay walls all round it. The bottom of the dock, which was covered throughout with a layer of puddle, was 29 feet below Trinity high water, and the surface of the quay was 5 feet 10½ inches above the same level. On the north side of the dock there were sixteen timber jetties, affording accommodation for thirty-two vessels, and opposite each jetty, in the line of the centre of the dock, were buoys for mooring the vessels.

The dock walls were composed partly of brickwork and partly of concrete. Upon a concrete foundation, front, cross, and back walls were built of brickwork, the intermediate pockets being filled with concrete. The back wall was only 14 inches thick, its chief use having been to keep the concrete in place until it became consolidated. The walls were built up about 4 feet 6 inches at a time, and the pockets were then filled with concrete to the level of the walls before another stage was commenced. The passage between the dock and the basin was 176 feet long and 55 feet wide; and having two pairs of reverse gates, the level of the water either in the dock or in the basin could be raised or lowered independently of one another. This was important for the satisfactory working of the two entrances, as high water did not occur at both at the same time. The foundations of the walls and of the floor of the passage consisted of concrete, the walls themselves being generally composed of solid brickwork, and the bottom of the passage being paved with ashlar masonry. The heel-post stones, the hollow quoins, and the cills were of granite; while the remainder of the stone-work was of Bramley Fall. The gates in the passage were of iron, with the exception of the heel-posts, the meeting-posts, and the cill-pieces, which were of greenheart timber. The gates were cellular, having two skins formed of iron plates separated by, and rivetted to, horizontal and vertical ribs. The skins were curved outwards, being arcs of circles whose radii were 60 feet and 120 feet; but the cill-pieces were straight and met at an angle of 126° in the centre of the passage. Each gate was erected on the floor, only a few feet from its ultimate position, and was tested by being filled with water. After being moved into their places, sufficient water was introduced into the gates to counterbalance their tendency to float. The basin was 600 feet long and 370 feet wide, and was surrounded by a quay wall precisely similar to the dock wall. The principal object of the basin was to serve as an immense lock during a rising tide; the water level being drawn down to that of the river when the tide had risen sufficiently, the gates were opened, and the vessels brought in, or *vice versâ*, until high water, when the gates were closed and the vessels in the basin could be passed into the dock at leisure. By this arrangement the water in the main dock could be kept at a uniform level. The New East Entrance Lock, connecting the basin with the river, was 3000 feet long between the gates, and 55 feet wide. The bottom consisted of a segmental brick invert, laid on a concrete foundation, with springing stones of Bramley Fall; while the gate floors and aprons outside the gates were of ashlar masonry. Being constructed upon the site of the old lock, the north wall of that lock was allowed to remain, and a new wall, 9 feet thick, was built in front of it. The brickwork of the south wall of the old lock was so solid that blasting had to be resorted to for removing it. For the purpose of filling and emptying the lock, and also for lowering the level of the water in the basin, there were sluices in the walls of each side at both pair of gates, in addition to sluices in the gates themselves. Beyond the entrance gates there were four outlets on each side, distributed along the walls so as to serve for clearing away any mud which accumulated on the apron.

The portion of the Blackwall and Millwall Extension Railway which passed through the land belonging to the West India Dock Company was carried out during the period of the execution of the other works. In this short distance three swing-bridges had to be constructed; two over the Blackwall Basin locks being for two lines of way one line being for the use of the East and West India Dock Company, and branching off to the north quay of the south dock; the other belonging to the Blackwall and Millwall Extension Railway, and going over the passage bridge, which was therefore only constructed for one line of way The width of the Blackwall Basin locks was 43 feet; as, however, the line crossed the locks on the skew, the portions of the bridges spanning the locks had to be made 66 feet 6 inches and 80 feet in length respectively between the pivots and the ends. A new roadway swing-bridge was also erected over the east entrance lock. The whole of the swing-bridges, gates, capstans, shuttles, and cranes were worked by hydraulic machinery.

The works were commenced in October, 1866. In January, 1870, the new roadway bridge was ready for traffic; and on the 5th of March in the same year the dock was formally opened.

The dock wall, as constructed, had cost only £12 2s. per lineal foot, a result which was chiefly due to the large employment of concrete. The total outlay on the works had been £571,139; viz., for the dock, basin, passage, entrance lock, and warehouse foundations £467,639, for the warehouses £60,000, for the railway £24,500, and for the hydraulic machinery £19,000.

The designs for the several works had been furnished by, and the works were executed under the direction of Mr. Hawkshaw, Past President Inst. C.E., the author being the resident engineer. Mr. Wythes, Assoc. Inst. C.E., was the contractor for the whole of the work, his representative being Mr. John Baldwin. The gates were sublet to Messrs. Easton, Amos, and Anderson, and the swing-bridges to the Park Gate Iron Company, the latter being erected under the superintendance of Mr. Joseph Phillips, Assoc. Inst. C.E., while the hydraulic machinery was supplied by Sir W. G. Armstrong and Co. (*From a Paper read at the Institution of Civil Engineers.*)

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

AT the meeting of the members of the Society on Tuesday, the 7th May, 1872—Mr. Hawksley, President, in the chair - H.R.H Prince Arthur, K.G., &c., was elected by acclamation an honorary member. Later in the evening the usual monthly ballot was taken, and resulted in the election of twenty-seven candidates, of whom four were members, viz., Mr. John William Gray, Engineer to the Birmingham Water Works Company; Mr. David Rowan, President of the Institution of Engineers and Shipbuilders in Scotland, Glasgow; Mr. Walter Henry Scott, Locomotive Superintendent and Resident Engineer of the Mauritius Government Railways; and Mr. Lionel Bury Wells, Engineering Staff of the London and North-Western Railway. Twenty-three gentlemen were elected associates, viz., Mr. Edgar William Bookingsale, Telegraph Construction and Maintenance Co.; Mr. Edward Pearce Brown, Stud. Inst. C E., Brixton Hill; Mr. Edmund Small Cathells, Gas Company, Montreal; Mr. Archibald Crellin Cregeen, Ex-Eng. P. W. D., India; Mr. Charles Edward Gael, B.A, Asst. Eng P. W. D., India; Mr. James Henry Greaves, Stud. Inst. C.E, Westminster; Mr. Charles Godfrey Gumpel, Leicester Square; Mr. John Prentis Hawley, Lambeth Water Works Company; Mr. Thomas Howard Head, Cannon Street; Lieutenant-Colonel Percival Robert Innes, St. George's Square; Mr. John Peake Knight, General Manager of the London, Brighton, and South Coast Railway; Rai Kunhya Lall, Ex. Eng. P.W.D., India; Mr. Simon M'Bean, Resident Engineer, Ceylon Government Railway; Mr. Frederick Herbert Mollett, Stud. Inst. C.E., Austinfriars' Passage; Mr. William Morris, Engineer to the Native Guano Company, Mr. Henry Thomas Munday, Stud. Inst. C E, East London Waterworks; Mr. Thomas Nuttall, Bury; Mr. James Smith Okell, Iquiqui, Peru. Mr. David Reid, Gampola, Ceylon; Mr. Thomas Reynolds, jun., Stud. Inst. C.E., Great St. Helen's, Mr. Charles Edward Robinson, Stud. Inst. C.E., Resident Engineer of the Yeovil Corporation Waterworks; Mr. Francis Frederick Smith, late of the Honduras Railway, and Mr. Frank Napier Thorowgood, Stud. Inst C.E., Tynemouth.

It was announced that, in accordance with the bye-laws, the Council had recently transferred Messrs. William Dyce Cay, Henry Hooper, Francis Langford O'Callaghan, and John Robinson from the class of associate to that of member; also that the following candidates had been admitted students of the Institution.--Messrs. Gilbert Beresford, William Patrick Brodie, Stephen Finney, Joseph Edward Fisher, Charles William Hodson, Lloyd Macdonald Hughes, Marmaduke John Monckton, Edmund Penny, Ralph Sadler, Ernest Hill Shadbolt, James Tait, Charles James Knight Watson, Horace Wilmer, William John Wilson, and Trevredyn Rashleigh Wynne.

AT the meeting of the members of the Society on Tuesday, the 14th May, 1872—Mr. Hawksley, President, in the chair—eleven candidates were balloted for and duly elected, including one honorary member, viz., Dr. John Percy, F.R.S.; one member, viz., Mr. George Henry Bayly, Resident Engineer, Bombay, Baroda and Central India Railway, Bombay, and nine associates, viz., Mr. John

Henry Holland, Adelphi; Mr. Charles George Kleberg, Inspecting Engineer for the Riga-Mitau, &c., Railways; Mr George Brooke Muriel, Engineer and Manager to the Ottoman Gas Company; Mr. Henry Rigg, P.W.D., India; Mr. Edward D. Romana, Assist. Engineer, Madeira and Mamoré Railway of Bolivia; Mr. Arthur Shanks, Calcutta; Mr. John Wade, Borough Surveyor, Barnsley; Mr. Charles Robert Western, Stud. Inst. C.E., Lambeth; and Mr. Thomas Plantagenet Bigg Wither, Tunbridge.

During the session just concluded the elections have comprised 3 honorary members, viz., H.I.M. the Emperor of Brazil, H.R.H. Prince Arthur, K.G., and Dr J. Percy, F R.S., 22 members, and 115 associates (16 of the latter having previously been students). In the same period the Council have transferred 17 associates to the class of members, have restored 1 associate to the register, and have admitted 64 students. On the other hand, by deceases and resignations, the Society has lost 1 honorary member, 6 members, 11 associates, and 5 students. At the close of the last financial year, on the 30th of November, 1871, there were on the books 14 honorary members, 724 members, 1048 associates, and 203 students, making in the aggregate 1989. now the numbers of the several classes are 16, 757, 1136, and 246 respectively, showing a gross total of 2155, and a net effective increase in one session at the rate of 8¼ per cent.

ZOOLOGICAL SOCIETY OF LONDON.

At the meeting of this Society on the 16th of April—Dr. E. Hamilton, V.P., in the chair—a letter was read from Dr. R. Schomburgh, of the Botanic Gardens, Adelaide, South Australia, containing an account of the apparently reasonable conduct of a monkey kept in the gardens. Mr. A. H. Garrod, prosector to the Society, read a paper on the mechanism of the gizzard in birds, in which he endeavoured to show that the ordinary action of this organ was that of compression, and not of trituration as usually understood. A communication was read from Dr. John Anderson, F.Z.S., on a supposed new monkey from the Sunderbunds to the East of Calcutta, allied to *Macacus rhesus*. A communication was read from Mr. W. H. Hudson, C.M.Z.S., containing remarks on the birds of the Rio Negro of Patagonia, as observed during a recent visit to that locality. To this was added an appendix by Mr. Sclater, giving a scientific account of Mr. Hudson's collections. A communication was read from Mr. Swinhoe, F.Z.S., containing descriptions of two new pheasants (*Phasianus ellioti* and *Pucrasia darwini*) and a new *Garrulax* (*G. picticollis*) from the vicinity of Ningpo, China. A paper by Mr. F. Moore was read containing the descriptions of a large number of new species of Indian Lepidoptera. Mr. E. W. H. Holdsworth, F.Z.S., read notes on a cetacean observed on the west coast of Ceylon, remarkable for possessing a long straight dorsal fin, and known to the natives as the "Palmyra-fish." Dr. A Günther, F.Z.S., read a paper on a collection of reptiles and amphibians made at Metang, in the district of Sarawak, Borneo; to which was added a synopsis of the known species of these classes hitherto recorded from that island. These were stated to be altogether 158 in number. Sir Victor Brooke, Bart., F.Z.S., gave a description of a supposed new species of gazelle from Ugogo in Eastern Africa, which he proposed to designate *Gazella granti*.

7th May, 1872. Professor Newton, V.P., F.R.S., in the chair.—The secretary read a report on the additions that had been made to the Society's collection during the month of March, 1872, amongst which were two red-necked bustards (*Eupodotis denhami*), presented by Mr. C. D. O'Connor and Governor Ussher, C.M.Z S., and a beatrix antelope (*Oryx beatrix*) from the Persian Gulf, received on deposit. Mr. P. L. Sclater exhibited and made remarks on a skull of the hairy tapir of the Andes (*Tapirus roulini*), obtained by Mr. Buckley during his recent expedition to Ecuador. Professor Owen read the eighteenth of his series of memoirs on the extinct birds of the genus Dinornis and its allies, in which was contained the description of the pelvis and bones of the leg of *Dinornis gravis*, a supposed new species allied to *D. crassus*, and a general *resumé* of the described species of the genus *Dinornis*. The Viscount Walden, F.R.S., communicated an appendix to his paper on the birds of Celebes, read at a former meeting of the society, and containing an account of twelve species to be added to the Celebean avifauna. This raised the total number of Celebean birds to 205. Mr. Henry Buckley exhibited the eggs of three species of North American birds, which he believed had never previously been obtained. The eggs were those of *Falco polyagrus*, *Elanoides furcatus*, and *Ictinia Mississippiensis*. Mr. H. E. Dresser exhibited the egg of *Querquedula marmorata*, collected in Spain by Major Irby, this being probably the first authenticated instance of the breeding of this bird in Spain. A communication was read from Mr. W. H. Hudson, C.M.Z.S., containing field notes on the habits of the swallows, of the genus *Progne*, met with in the Argentine Republic. To this was added some notes on the species by Mr. P. L. Sclater. A communication was read from Mr. G. French Angas, C.M.Z.S., containing descriptions of ten new species of land and marine shells, mostly from Australia. A second communication from Mr. Angas contained the description of a new species of *Voluta*, proposed to be called *Voluta hargravesi*. A paper by Mr. H. Adams was read, in which he described a new species of *Geotrochus* from the island of New Britain, proposed to be called *G. fergusoni*. A communication was read from Dr. J. E Gray, F R.S, containing a description of *Peltastes forsteni*, a species of land tortoise from Celebes. Two communications were read from Mr. J. Brazier, C.M Z.S, giving descriptions of land and marine shells collected in Australia and Lord Howe's Island. A communication was read from Mr. A. Anderson, F Z.S., containing some additional notes on the raptorial birds of North-Western India. A paper by Dr. J. E. Gray, F R S., was read, describing a young tapir from the Peruvian Amazons, which he proposed to call *Tapirus terrestris peruvianus* A communication was read from Dr. J. E. Bowerbank, F.Z.S., containing the third part of his contributions to a general history of the *Spongiadæ*.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

At the meeting of this Society on Tuesday, May 7th, 1872—R. Cull, Esq., in the chair—the following new members were proposed for election by the Council:—Edward Chevallier, Esq., M.R.A.S.; St John Vincent Day, Esq., M.D., F.R G.S; Charles Fox, Esq.; Miss Charlotte Ifold, Thomas Jenner, Esq; Rev. Arthur Jones, M.A., Master of Aske's Hospital; David Mocatta, Esq., F.R.I.B.A., F.S.A.; William Nicholson, Esq., A.S.A.; Iltudus T. Prichard, Esq., F.R.G.S; Mrs. Cattley; Mrs. Ranyard; and Rev. Canon Northcote, D.D.

"On Underground Jerusalem; more particularly in reference to the Plateau of the Haram es Shereef." By William Simpson, Esq., F.R.G.S.—In this interesting paper the author gave an introduction to the subject of Jerusalem as one of the important subjects connected with Biblical archæology which must come often before the Society. The paper described Omar's search under the guidance of Sophronius, the Patriarch of Jerusalem, for the site of the Temple, as one of the first explorations into the topography and archæology of the Holy City. The transference of holy places from one point to another was explained as involving confusion and adding to the difficulties of arriving at reliable facts. The principal theories respecting the site of the Temple and the Holy Sepulchre were defined and their merits touched upon so far as to indicate the progress of the questions connected with them. The importance of a careful study of the various styles of building in the Haram Wall was pointed out, so as to get a date, if possible, as a ground upon which to start. A most interesting part of the paper was a description of the Great Sea, excavated out of the solid rock, under the Temple site, and the supply of water to it from the pools of Solomon near Bethlehem; the great importance of the water system for the Temple uses having an essential bearing on the question of the topography, and the question was still one which required further knowledge and study to arrive at a definite result.

"On the so-called New Moabite Stone, described in a late letter to the *Times*." By B. G. Jenkins, Esq.—The author of the paper considered that the letter and the inscription bore their own condemnation; for the stone could not be Moses' memento of the conquest of a land he never attacked. He, however, utterly defeated Sihon, king of the Amorites, at Jahaz, the modern Jazaza, two miles from the Arnon, and therefore the inscription ought rather to have been "We drove them away—the people of Heshbon at Jahaz," instead of "The people of Ar Moab at the marsh ground." In regard to a supposed identification of "Ar Moab at a marsh ground" with "the city that is in the midst of the river" of the 13th of Joshua, Mr. Jenkins showed that the latter should be "the city that is in the midst of the valley," the word *nachal* meaning both a river and a valley, the same expression occurring in the 24th of 2 Samuel. He further expressed his belief that Ar Moab, the city or metropolis of Moab, was not on the Arnon, but identical with Rabbath Moab.

At the conclusion of the reading of the foregoing papers the Sepher Torah from Arden, lately presented to the Society by Capt. F. W. Prideaux, was exhibited, and a report by Rabbi Dr Schiller Szinessy was read. This would, the president stated, in due course be published. The result of the learned Rabbin's examination was that the roll was written on eighty-one skins of various dates, containing in 237 columns the entire Pentateuch with the exception of two or three verses. The dates of the different sections averaged, some from the tenth and the remainder from that period to the fifteenth century. There were also many philological peculiarities and details of archæological interest in the arrangement of the roll itself, which followed the rules prescribed by the Babylonian Talmud. On the whole, the MS. was one of the most valuable, and, further, one of the earliest copies of the sacred books in this or any other country as far as yet has been discovered.

REVOLVING PUDDLING RABBLE.

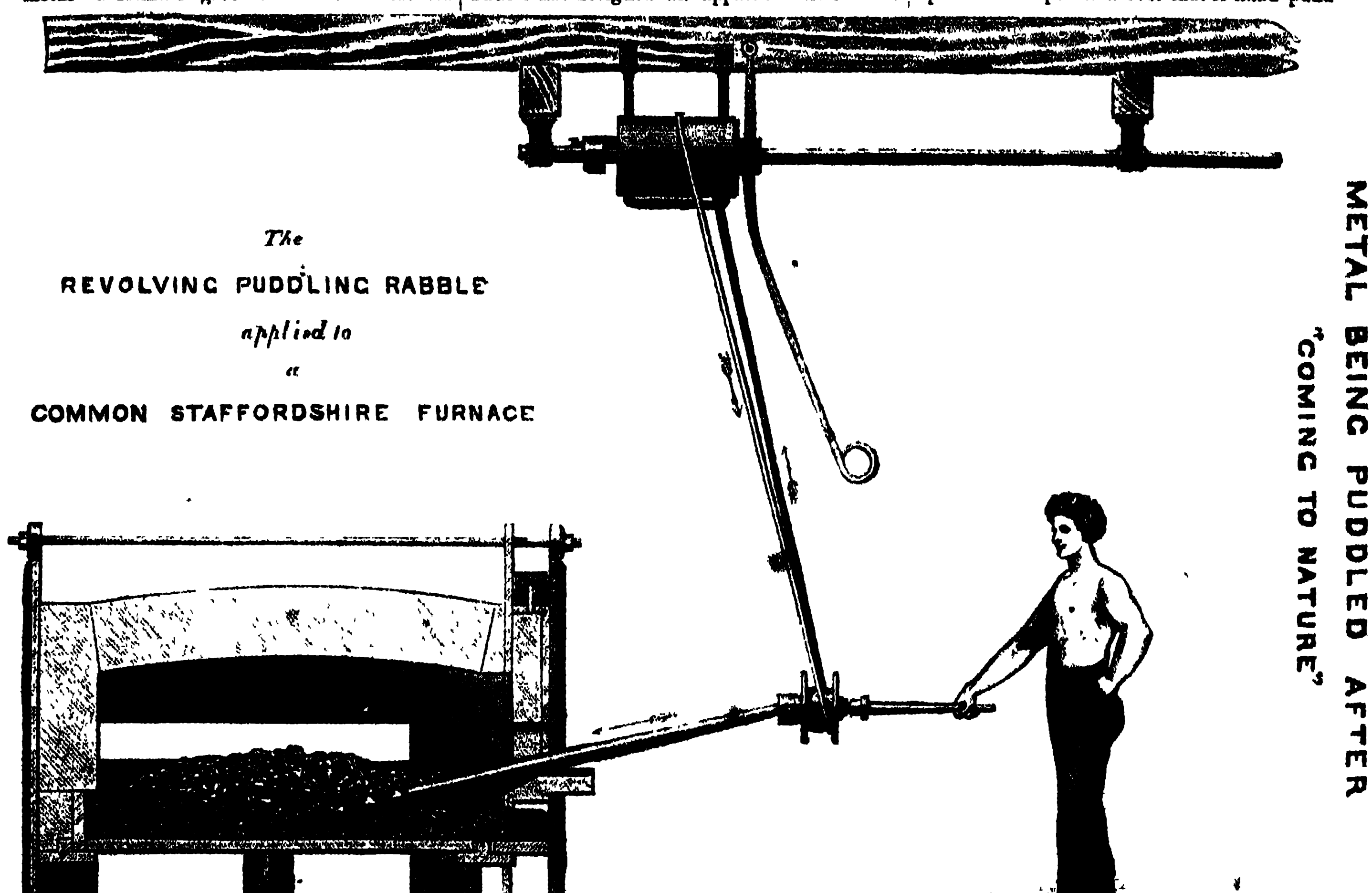
One of the earliest attempts (Hazlehurst, 1854) to puddle by machinery embodied the idea of a revolving rake, and this is stated to have been comparatively lately (Bayliss, 1860) revived in an experimental furnace, and with good results. As a rule, however, rotating rakes have been found to soon get clogged up with iron and cinder; while, even if successful in the fluid metal, the mere mechanical resistance would be most destructive as the iron "came to nature." A more refined mechanical idea would consist in simply giving the ordinary hand rabble a rotary motion, while still allowing it to be guided by the hand of the puddler. To Mr. Edward Hutchinson, of Messrs. Pease, Hutchinson, and Co., Skerne Iron Works, Darlington, belongs the merit of having first invented and experimented with the revolving rabble. His trials were very successfully carried out as long ago as 1865; being, however, relinquished during the same year, and without having been published in any way. Monsieur Dormoy, quite independently, took up the same idea, and has been perseveringly working it out since 1866.

Any puddling machinery must be essentially simple, and non-liable to get out of order by the roughest and most careless usage. This simplicity, required by the men, is also required by the furnace, the high temperature of which, with the attendant rapid current of air passing through, must not be interfered with. A glance at the accompanying illustration will render the whole apparatus intelligible. A

common belt, driven from shafting about six feet above the furnace, rotates the sheave, loosely jointed at one end to the puddling rabble, and at the other turning on a pin held in the hand of the puddler. To prevent any jarring action to his hand, the pin he holds may be wound round with spun yarn or gasket, embraced by a leathern or india-rubber tube. The strap thus rotates the rabble, supports part of its weight like a suspension link, and acts as a universal joint, much as in the familiar instance of the rotating hair-brush. The belt must evidently adapt itself with ease to the great variety of positions which have to be taken by the tool in every part of the furnace; to the necessity for removal when too hot; and to the progressive changes in the metal. Mechanism could easily be applied to the rotating rabble in order to work it regularly to and fro; but this additional complication has not been found necessary. Its great speed—from 300 to 800 revolutions per minute for white pig, and from 800 to 1000 for grey metal—is found to give it all the mechanical four months without renewal. Any diminution in speed can be obtained by slightly relieving its weight off the belt, thus allowing more or less slip. On the other hand, any unusual resistance can be overcome by the puddler pressing the tool down on the belt. Simply by crossing the strap the rabble can be rotated from left to right, or *vice versâ*, alternately, as required. The tools, in spite of their extra weight, are easily removed from the furnace by taking them off the strap by means of a hook on a light chain suspended near the furnace from the roof, and laying them on small trestles about eighteen inches in height and width. The rabble can thus be changed in thirty seconds. There is no chance of the tool disturbing the fettling, as it merely rests loosely with its weight on the bed, just as in hand-working. Experience has shown that the revolving rabble involves no change either in the plant of the works or in the habits of the workmen; it could be adapted in a couple of hours to any common furnace; and the author has designed an apparatus that could well known that the more the iron has been worked, and the better it has been puddled, the less is the necessity for forming it into well-shaped balls, as it is so easily kneaded under the hammer. It has everywhere been noticed—in France, Hungary, and Styria—where the revolving rabble has been used, that the balls produced were very close, withstanding remarkably well the shock of the hammer.

The ordinary rabble is only about an inch and a quarter square, it consequently easily gets too hot, then requiring to be taken out. The rotary rabble, with a diameter of two and a half inches, and weighing about eighty pounds, lasts from a fortnight to one month; some have even lasted as long as six months, though this is exceptional. Should this tool get too much heated and take a slight bend, it can be straightened even while it is turning by slightly forcing the bent part against the side of the hole in the door.

As already pointed out, any saving in fuel would necessarily be in the direct ratio of the speed of the operation over that of hand-pudd-



energy required. The end of one form of rabble, about four and a half inches in diameter, when revolving with 500 revolutions, necessarily has a speed at its circumference of nearly 600 feet per minute. On the other hand, the iron, even when boiling, is not thrown up. The centrifugal impulses are not sufficient to overcome the cohesion of the hot metal. The power required has been indicated by Herr Biedermann, now of Floridsdorf, near Vienna, at from one-quarter to one-half of a horse-power per furnace per hour; but the draught would necessarily increase towards the end of the heat. There is no bearing near the furnace necessarily liable to get hot, no gearing to break on any sudden resistance, and the strap itself acts in its usual way as an admirable friction brake. It is difficult to imagine how the apparatus can come to grief in any other way besides breaking the strap. For such a case a spare belt is kept hanging on the shaft, or the puddler could even merely go on in the ordinary way. If kept well greased, however, the belt lasts from three to be at once applied. The thing is also singularly cheap, as can be seen at the first glance; and cheap tackle—it can scarcely be called a machine—means also cheap repairs. The great question of wear and tear, only safely determinable by long usage under the most varied circumstances, is, indeed, often forgotten when examining a new machine.

Even at the very beginning of the heat the greater command of puddling power has an important result. The "yield" is found to be greater as there is less liability of the pig-iron while being melted in the furnace getting burnt therein for want of regular stirring. But in one very important point it is more useful than any other known apparatus applicable to a common furnace. Even when the iron is "come to nature" the tool can be worked like a drill through the tough, pasty mass. The operation can be thus entirely completed if the mass has not to be balled. If balls have to be made only about ten minutes' work with the ordinary hand rabble has to be done at the end of each heat. Further, it is ling. With charges of even 800 or 1000 lbs. of grey pig, the working of the revolving rabble only lasts from twenty to thirty minutes; with white pig, from ten to fifteen minutes. The metal is then in separate pieces, almost ready to be taken out. No pig iron, however much carburetted or otherwise alloyed, has been able to withstand its action. Either soft fibrous iron, fine-grained iron, or steel can be produced according to the wish of the puddler.

Mr. Hutchinson, in a letter to the *Iron and Coal Trades Review* of April 17th, states that with his rotary rabble "he could puddle a heat of grey iron in an hour, and with very little labour on the part of the puddler." He considers "that, by the adoption of some such simple contrivance as this, in conjunction with the plan of working three shifts instead of two in the twenty-four hours," "a clear saving of ten shillings per ton on puddling could be effected, without the complete and immediate substitution by costly machinery of the puddling furnace at present in use." At present the Cleveland puddlers finish only

six heats per shift of twelve hours, or one heat of about four and a-half cwt. per two hours, instead of the one heat per hour cited by Mr. Hutchinson. Supposing that during the proposed shift of eight hours they turned out only six heats, or eighteen heats instead of twelve in the twenty-four hours, this would be equivalent to increasing the rate of production of the common puddling furnace by more than thirty-three per cent., or one-third. In other words, the same furnace, with the same amount of coal, would produce in eight months the same amount of iron it now turns out in twelve. This would be equivalent to a saving in coal alone of more than one and one-third million of pounds sterling per annum, without reckoning the gain in time.

A tool like this would do for the puddler what the slide-rest has done for the metal turner. While actually increasing the demand for his labour, the slide-rest has raised the metal turner from an overworked drudge to a skilled operative, able to work at his trade from youth to old age. Even if the ironmasters were to use the revolving rabble merely to relieve their men, and without requiring a greater number of heats from them, they would gain :—

1. A great improvement in the quality of the iron produced

2. A great diminution in the number of ruinous "cobbles" or "wasters."

3. The capability of working up very grey or also inferior kinds of pig, without using any "fined metal."

4. A diminution of loss in mill scale between the rolls.

Messieurs Paris, Guyot, and Huin, of St. Dizier, state that "the mere saving in waste iron would be sufficient to induce them to employ the apparatus." This is more especially the case when manufacturing special and merchant bars that have to be rolled from piles.

As already observed, the reverberatory furnace is notoriously a bad apparatus for melting. In melting for the Bessemer converters, for instance, it has been superseded by the cupola. For reasons adduced, the use of the rotary rabble should evidently be combined with that of a melting cupola. The men have sufficient command over the work to be able to overcome any extra carbon in the metal. In fact, if the metal be charged in a molten state, the heat can be completed in, at the most, half an hour or forty minutes. With thorough hand-puddling the "yield" has been found to be increased beyond the charge of metal when rich fettling has been employed, just as in Mr. Danks' furnace. Mr. C. W. Siemens, in his regenerative puddling furnaces, has also found the "yield" increased by the reduction of the fettling. Similar results are to be expected with an efficient aid to the puddler.

The true way to use this tool would, of course, be, not merely to melt the metal in a cupola, but to increase the charge, and with it the capacity of the bed, and to use a furnace with two doors. Double furnaces have often been tried, but they have been found impracticable with manual labour, from the self-evident cause that the work is so much increased. This portion of the subject, as it relates to furnaces that would have to be specially built, need not now be considered.

We are indebted to Mr. Frederick A. Paget, C.E., for the foregoing particulars as to this very important invention, which formed the subject-matter of a paper read by him at the Society of Arts on the 8th of May.

WORKING MEN AND THE PATENT LAWS.

At a meeting of the Labour Representation League, held on Saturday—Mr. R. Marsden Latham, the president, in the chair—the report by the Select Parliamentary Committee on the Patent Laws, just published, was discussed. Much dissatisfaction was expressed with the report, and at the fact that members of the working classes had not been called to give evidence before the committee, the constitution of which body was objected to on the ground that its composition consisted two-thirds of manufacturers and parties representing interests antagonistic to those of inventors. It was also urged that a fair and complete inquiry into so important a subject as the Patent Laws could only be satisfactorily effected by a Royal Commission representing all the interests in the community, and steps were ordered to be taken with the view of ensuring an exhaustive inquiry into the whole subject by that means. It was also agreed that a deputation should wait upon the Council of the Inventors' Institute in order to obtain their aid and co-operation in the matter. And the following resolution, proposed by Mr. Thomas Mottershead (silk weaver), and seconded by Mr. Samuel Brighty (wood turner), was carried unanimously :—"That the recommendations of the Select Committee of the House of Commons on the Patent Laws are by no means likely to benefit the most numerous class of inventors, namely, the artisans; and, if carried into effect, would render the obtaining of a patent more difficult, cumbersome, and expensive than at present. Moreover, the committee's recommendations do not provide what the generality of inventors stand in need of, namely, an assimilation, as far as practicable, of the laws affecting invention-right to those of copyright, and especially increased facilities for the obtaining by inventors of a valid property in their own inventions at a reasonable cost, as is now advantageously done in Belgium, France, and other countries whose patent laws are in advance of those of this country."

PRESERVATION OF GRAIN.—MEETING AT CANNON ST. HOTEL.

On Wednesday afternoon, May 9, a large number of gentlemen, amongst whom was the Greek Ambassador, assembled at Cannon Street Hotel for the purpose of inspecting an invention of Mr. Joannides for preventing the heating and mildewing of grain when in a ship's hold or in a granary. In the absence of Sir Antonio Brady, Mr Campin presided over the trials which were made. Mr. R M. Latham and Mr. Burleigh, C.E., expressed their approval of the principle of the invention. Incidentally it was mentioned that his Majesty the King of Greece had been so impressed with the importance of the apparatus, that he had decorated Mr. Joannides with the Cross of the Saviour as a mark of his Royal approval.

Correspondence.

*** Discussion is invited upon any subject within the scope of the Scientific Review in which its readers may be interested; but correspondents are requested to be brief, as space is limited, and to remember that each individual writer is alone responsible for the opinions he may express.

ON COMETS

To the Editor of the Scientific Review.

Sir,—In my letter to you published in the number for July, 1871, I expressed my dissent from the generally received explanations of the phenomena connected with comets, and suggested that these might be explained more satisfactorily by the well-known laws of physics.

As my opinions are somewhat modified, I hope you will allow me to reproduce them rather less briefly than on that occasion.

When a large comet is about as far from the sun as the earth is, a tail sometimes appears. As the comet is perhaps 100,000 miles in diameter, the attraction of the sun for the nearer parts is greater than for the more distant, therefore these distant parts do not fall so rapidly towards the sun, and form a tide or tail.

The tail towards the sun is generally invisible or absent. The greater heat and light on that side may render it invisible; and as attraction between bodies is as the sum of their masses, the dense nucleus must fall a little more rapidly towards the sun, and leave it less rapidly than the rare coma, and thus generally occupy that part of the comet which is towards the sun. A resisting medium may also have something to do with it.

As the comet approaches the latus rectum its course becomes more circular and more rapid; and the tail having previously rather less velocity than the body, may be left slightly behind, and a new tail formed by the more distant part of the coma on account of its greater centrifugal force. Another cause of an additional tail may be the attraction of a planet. But I believe the most frequent cause for that and for the fantastic appearance which tails sometimes assume, is the attraction of, or a collision with, a mass of aërolites. Such may have been the causes also of the separation of Gambart's comet into two parts.

When a large comet comes near the sun, on account of its enormous expansion by the heat, and the greater centrifugal force of its more distant parts, it has a long tail: the greater part of this must be beyond the feeble attraction of the comet, and as it has a greater velocity than accords with its distance from the sun, it starts off at a tangent at the rate of perhaps 250 miles a second; and as the comet is going in a different direction at a greater rate, the tail has the appearance of being repelled by the sun at the rate of 500 miles or more per second. But as the velocity of the comet of 1843 at perihelion was 366 miles per second (Herschel), such a rapid evolution of tail does not require for its explanation that a new power of repulsion should be attributed to the sun.

The comet, after its perihelion passage, where it has been exposed to a heat capable of volatilising probably every substance of which it is composed, sometimes reappears very small, most of it having become a gas invisible from the great heat and light. As it recedes from the sun this gas, being exposed to less and less heat, becomes more and more a visible vapour by condensation, so that the comet has the appearance of rapidly enlarging as it leaves the sun. The reverse of this takes place as the comet approaches the sun.

Sometimes it reappears accompanied by a long tail This, formed partly by the remains of the old tail, has been rapidly increased by the great centrifugal force of the more distant parts of the vastly expanded comet. From the greater centrifugal force of the more distant parts of the tail much of it is no doubt lost to the comet; what remains precedes the comet more and more, as the velocity of the comet becomes less and less, and is gradually absorbed.

Thus I have traced a comet through its most remarkable phases, and these all seem to be explicable by the well-known laws of physics, or at least more likely to be so than by any mere supposition unknown to science.

I am, your obedient servant,

Walter S. Carmichael, M.D.

Annandale Street, Edinburgh,
20th May, 1872.

The Inventors' Patent-right Association, Limited.—This now well-known and ably conducted Association, the prospectus of which appears in the advertising columns, is, as may be seen from the list of recorded specifications, transacting a large patent business. Its organisation for obtaining patents combines so great economy in the charges with sterling efficiency, and its arrangements are so complete for unravelling disputed questions of patent-right, that it is gratifying to find former predictions as to its success fully borne out by the results. Members of the Inventors' Institute, to whom, moreover, it affords special advantages for obtaining and maintaining patent-rights, largely avail themselves of the services of the Association.

(Continued from page 82.)

puddling iron.—1197. G. K. E. Fairholme. Household fire-escapes.—1198. S. Johnson and A. Johnson. Plumb-rule and level.—1199. J. Hunt. Apparatus for winding thread or yarn upon pirns or bobbins.—1200. J. F. M. Pollock and J. Mitchell. Kilns.—1201. L. Fontana. Treatment of certain substances employed for some surgical and therapeutical applications.—1202. W. R. Lake. Burner for lamps and other illuminating apparatus (com.)—1203. H. B. Barlow. Apparatus for cooling wort and other liquids (com.)—1204. F. H. A. Hoyer. Press for printing and copying.—1205. W. Ferry. Cistern filters.—1206. T. J. Smith. Manufacture of buttons (com.)—1207. G. Little. Electric telegraph apparatus and in circuits employed in telegraphing.

On 23rd April.—1208. L. T. Groussin. Infants' cradles or cribs.—1209. E. Peyton. Spring mattresses and other elastic surfaces for sitting and reclining upon.—1210. A. M. Clark. Motive-power engine, applicable also as a pump (com.)—1211. W. H. Davey. Washing machines.—1212. N. Thomas. Heating feed water supplied to steam boilers.—1213. W. A. Lyttle. Poles for telegraphic and other purposes.—1214. J. Kite. Apparatus for blast for [illegible] cooking.—1215. J. W. Gray. [illegible] composition to be used as a paint and for other purposes (com.)—1216. A. Cochrane. Improved mode of and apparatus for facilitating the learning of languages, arithmetic, and other sciences (such as [illegible] and anatomy) in which diagrams or pictorial illustrations are required.—[illegible] J. [illegible] ridge. Equilibrium [illegible] A. M. Clark. Hardening [illegible] articles (com.)

On [illegible] April.—[illegible] Apparatus for [illegible] water and [illegible] and [illegible] furnaces.—1221. W. Brougham. Communication between railway passengers and the [illegible] driver of railway trains.—[illegible] Portable machinery for [illegible] clover and trefoil, and [illegible] kinds of seeds.—1223. W. A. [illegible] Manufacture of shells and shot, and in the machinery or apparatus employed therefor [illegible]—1224. E. Sumner and W. Lambert. [illegible]—1225. A. [illegible] Method of [illegible] the labels on [illegible] bottles, and other similar vessels on the cork or stopper [illegible]—1226. [illegible] Working [illegible] on railway [illegible] brakes [illegible]—1227. T. Midelton [illegible] adhesion in railway [illegible]—[illegible] R. Maynard [illegible]—1229. C. G. Kleberg. Manufacture of [illegible] apparatus employed therefor.—1230. W. Richardson and [illegible] gins.—1231. W. Cunningham. Stopping, combing, and beating jute, flax, and other fibrous substances, and in the machinery or apparatus employed therefor.—1232. L. Forbet and L. Lemoine. System and machinery for removing smoke, vapour, and gas proceeding from locomotive engines in tunnels of railways.—1233. H. H. Doty and E. T. Gardner. Roof lamps for railway carriages.

On 25th April.—1234. L. W. Pritchard. Valves.—1235. W. C. Holmes and W. Hollinshead. Process of manufacturing gas, and in the apparatus employed therein.—1236. J. K. Collett. Packing and preserving butter.—1237. M. Condie. Sewing machines.—1238. F. Durham and H. E. Hupton. Indicating or checking apparatus.—1239. B. Naylor and T. Geldard. Machinery or apparatus for tilting barrels, casks, or other receptacles.—1240. H. Gahn. Improvements in cosmetics called "amykos."—1241. J. Bain. In screw drivers (com.) 1242. C. W. Vick and J. Cooke. Machinery for feeding, preparing, and carding engines.—1243. S. W. Rich. Manufacture of sulphates.—1244. W. R. Lake. Steam-engines and parts connected therewith, chiefly designed for the propulsion of street vehicles (com.)—1245. A. M. Clark. Drying and bleaching fabrics and fibrous materials, and in apparatus for the same (com.)

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The Scientific Review.

JULY 1, 1872.

THE MIND-WORKER AND THE HAND-WORKER.

In the present day the hand-worker is demanding fuller recognition of his position and rights socially and politically; but we hear little of the claims of his twin brother, the mind-worker, and for this silence are at a loss for a reason. Is it that the condition of the mind-worker is satisfactory? Let those who know the life of both answer, as many who belong to the ranks of both only can answer. Have handicraftsmen who have joined the inventors' ranks found that the position of the latter is a more satisfactory one than that of the craftsman? We trow not.

The ordinary workman has only to unionise and work on, and his cause is sure of a successful result in these days when movements for his benefit are no longer merely national, but have expanded into international movements. On the other hand, the inventor is by his very nature prone to segregation. He is essentially solitary in his views and action. He must study and work in isolation, for association with others hinders rather than helps his onward course. But "union is strength," and no man singly who is not a host in himself can do more than work and work and be left to the reward of virtue—work as his daily occupation, work as his reward.

The votaries of pure science often fare even worse than the inventor. If rich men they may possibly attain to the possession of the "bubble reputation"; they may become "F.R.S.," or be knighted. If poor men they may become known as wonderful specimens of humanity, something analogous to what learned pigs are amongst porcines.

Now this condition of things is not pleasant for the mind-worker, or good for the prosperity of the State. Invention means progress—non-invention means retrogression. Our armies no longer rely upon physical force alone, not even when organised and trained up to the highest pitch of efficiency in its exercise. They demand improved implements of warfare, and new processes derived from the chemical laboratory for the preparation of ammunition.

Our railways and telegraphs are acknowledged children of the inventor, and even our ships are now commonly dependent for propulsion on mechanical application of steam and other scientific aids that almost bid defiance to winds and waves. And yet, great as are the improvements which the inventor has ushered into the world, the world still emulates the horse-leech's daughter of the Scriptures, and cries out "More! more!"

In the regions of pure science the same demand for constant progression is made, and the intellectuality of the man of science is taxed to the uttermost. He must not only be profound, he must be brilliant; he must not only be sound, he must be original; and yet for all this, of the few prizes open to him scarcely any of them reach to an annual income so great as that of a door-keeper of the House of Commons.

The artistic mind-worker is scarcely more favoured than his brethren. It is true he can produce his work of art and at once offer it for sale in a well-established market frequented by buyers, but he has little chance of satisfactory success unless he can do something sensational; and although he might be useful to his country as a teacher of art, there are no prizes of this sort open to him, unless he likes to sink his independence and become one of the toadies of the Government departments of public taste, or can manage to strike the fancy of dignitaries of the Church having large funds to deal with, who feel (as clerics usually do feel) no hesitation in pronouncing that to be right which personally they think to be so, although others pecuniarily interested in the matter may happen to differ with them on grounds supported by common-sense.

Now it seems to us that the remedy for all this is to be found in aggregation and organisation in a federalised connection of all branches of brain-work (except Law, Physic, and Divinity, as regard their professional aspects). In short, we want a confederation of scientifics and artistics (and even literarians), so that the views, wishes, and interests of each and of all may be duly discussed, and measures from time to time concerted for their practical expression and advancement.

Doubtless the realisation of such a gigantic scheme as the one we have adverted to is a heavy business—in fact, it has a magnitude that may well be deemed appalling; but as "Rome was not built in a day," so a long march may be accomplished by a succession of small steps. All that need be done at present is to make a start in the right direction. But what is the right direction? That is doubtless a momentous question; but it is not such a difficult one as many may imagine. If one wants to keep bees, the first thing is to get a hive to house them in. So also to accomplish the great work we have referred to, and beyond that enable a friendly acquaintanceship to be maintained with the hand-worker, who is the agent for giving reality to the labours of the mind-worker, it is necessary that suitable buildings should be provided in such contiguity and connection as to be in effect one structure. In short, the first thing that has to be done is to effect the practical realisation of the plan some time ago proposed by Captain J. H. Selwyn, Mr. R. M. Latham, Mr. Robert Richardson, and other members of the Inventors' Institute, for the erection of buildings at the back of the National Gallery in Trafalgar Square, where the scientific, artistic, and learned societies might be housed, and provision made for lecture and exhibition halls, to which working-men and others might resort for scientific and technic-science instruction. As the house in St. Martin's Lane in which the Inventors' Institute meets probably will be shortly pulled down, the present seems to be an opportune time for moving in this matter. Moreover, Leicester Square is now waiting for an occupant, and by utilising that open space, and increasing it by adding to it on the south side, a magnificent site could be obtained. We commend this project to the notice of the Government, and confidently ask for the aid of the Council of the Inventors' Institute, and all other societies that may feel interested in the object, in effecting its realisation.

Reviews.

Science Primers —Edited by Professors HUXLEY, ROSCOE, and BALFOUR STEWART.—II. Chemistry. By H. E. ROSCOE, Professor of Chemistry in Owens College, Manchester, Author of "The Spectrum Analysis," "Lessons in Elementary Chemistry," &c. With Illustrations.—III. Physics. By BALFOUR STEWART, Professor of Natural Philosophy, The Owens College, Manchester, Author of "Elementary Lessons in Physics." With Illustrations. London and New York: Macmillan & Co. 1872.

WE hail with delight the appearance of these works, for they assure us that the popular education of the future will include an amount of knowledge of the practical and experimental sciences which must reach far beyond "smattering," as any one who reads these little books will at once admit. Indeed, we can truly say that we have never met with such an amount of useful science teaching in so small a compass before, the only drawback is the temporary one of the non-appearance of the introductory Primer by Professor Huxley.

The first of these Primers, that on chemistry, commences with an introductory section giving a general idea of the science of chemistry, and after this the nature of fire is brought before us by information regarding what happens when a candle burns, and it is shown that heat is felt when chemical union goes on. Air is then introduced to notice by showing what the air contains, what goes on when we breathe the air, action of plants on the air, growth of plants, action of animals and plants together. Water is the next subject, under which head we have teaching as to what water is made up of; and it is shown that hydrogen can be got from water, how hydrogen can be collected, that hydrogen burns and is lighter than air, that water is formed when hydrogen burns, difference between salt and spring water is demonstrated, and solution and crystallisation are explained, together with many other chemical facts about water. Earth such as water, and under this head the metals and coal are referred to; non-metallic elements and metals being dealt with by separate sections, the last section being reserved for results. From which latter section we take leave to make the following quotation, for it contains information which will show our readers that something beyond play-book chemistry is to be found in this work. -

Our chemical shorthand means, however, more than I have yet told you. If I write the symbol O, or the symbol Hg, I signify thereby not any weight of oxygen or of mercury, but exactly the combining weights of these two elements. O means 16 parts by weight of oxygen, and no other weight; Hg means 200 parts by weight of mercury, and no other weight; and therefore I have written O = 16 and Hg = 200 in the table.

Now supposing I want to write the chemical symbol for a compound, I have only to put the symbols of the elements it contains alongside of one another. Thus HgO signifies oxide of mercury; and this symbol not only tells me that the compound contains oxygen and mercury, but it tells me how much oxygen and how much mercury the body contains, because I remember that O means 16, and Hg means 200; so that the chemical symbol, or formula, is most useful as expressing not only the qualitative composition (or what the body contains), but also the quantitative composition (or how much of each thing the body contains). Thus, again, CaO means calcium oxide, or lime, and exactly 40 and 16, or 56 parts by weight of lime; ZnO means zinc oxide, but 65 and 16 or 81 parts by weight; whilst H_2O signifies water, being twice H, or two parts by weight of hydrogen combined with 16 parts by weight of oxygen to form 18 parts by weight of water.

Some of the elements combine together in different fixed proportions, forming several compounds. Thus nitrogen and oxygen unite to form five different compounds, as follows:—

The first compound, called nitrogen monoxide, contains 28 parts by weight of nitrogen, to 16 parts by weight of oxygen.

The second compound, called nitrogen dioxide, contains 28 parts by weight of nitrogen, to twice 16, or 32 parts, by weight of oxygen.

The third compound, called nitrogen trioxide, contains 28 parts by weight of nitrogen, to three times 16, or 48 parts, by weight of oxygen.

The fourth compound, called nitrogen tetroxide, contains 28 parts by weight of nitrogen, to four times 16, or 64 parts, by weight of oxygen

The fifth and last compound, called nitrogen pentoxide, contains 28 parts by weight of nitrogen, to five times 16, or 80 parts, by weight of oxygen.

Now remembering that N means 14, and that O means 16, we can easily write the symbols for the above compounds.

The first compound contains 28 parts, or two combining weights of nitrogen, to 16 parts, or one combining weight of oxygen Hence we write the symbol of this compound N_2O.

For a like reason we write the formula

Of the second compound N_2O_2

,, third ,, N_2O_3

,, fourth ,, N_2O_4

,, fifth ,, N_2O_5

Note.—The small figure written below the symbol means that the weight is to be taken more than once. O_3 means Oxygen = 16 taken three times, or 3 × 16 = 48.

From this we see that the weight of oxygen contained in the four last of these compounds is twice, three times, four times, and five times that contained in the first compound And, moreover, we find that it is not possible for us to prepare a compound containing any intermediate quantity of oxygen. If, for instance, we try to combine 28 parts by weight of nitrogen with 20 parts by weight of oxygen, we get the whole of this nitrogen combined with only 16 of the oxygen, the other 4 parts of oxygen remaining uncombined. Here, then, we have arrived at the two most important laws of chemical combination —

1. The law of combination of the elements in fixed proportions, called the combining weights.
2. The law of combination in multiple proportions of these combining weights, when several compounds of the same two elements exist.

MEANING OF A CHEMICAL EQUATION.

You will now be able to understand that all the chemical changes which I have spoken of, and which you have seen, or ever will see, can be written down in symbols. Every one of these changes is definite, and in every case we can get to know not only what has taken place, but also how much of each substance has been formed. Let us take one or two examples. If I want to prepare nitric acid (Experiment 38), I take nitre (potassium nitrate) and sulphuric acid, then nitric acid distils over, leaving potassium sulphate in the retort. Now what happens in this change? and how much sulphuric acid and how much nitre am I to take, so as not to waste either? In order to find this out I must write down the formula for nitre and for sulphuric acid. Nitre is written KNO_3*: that is, it contains three elements—potassium, K = 39; nitrogen, N = 14: oxygen, O^3 = 3 times 16, or 48. Sulphuric acid is written H_2SO^4; that is, it contains hydrogen, H^2 = twice 1, or 2; sulphur, S = 16; oxygen, O^4 = 4 times 16, or 64. When we mix these two compounds together a change occurs; half the hydrogen (H) in the sulphuric acid changes place with the whole of the potassium (K) in the nitre, and two new substances are formed, viz., HNO_3, nitric acid (which distils off as a yellow liquid), and $KHSO_4$, sulphate of potassium, which remains in the retort as a white solid salt. This change we can therefore express in an equation, thus—

Before the change.		*After the change.*
Nitre and Sulphuric Acid	yield	Nitric Acid and Potassium Sulphate.
$KNO_3 + H_2SO_4$	=	$HNO_3 + KHSO_4$

This shows us, then, exactly what takes place; nothing is lost; the nitric acid and potassium sulphate which we get weigh, taken together, as much as the nitre and the sulphuric acid which we took. We see this clearly if we write down the numbers which those symbols represent.

39 & 14 & 48 and 2 & 32 & 64		1 & 14 & 48 and 39 & 1 & 32 & 64
101 & 98		63 & 136

The equation then tells us that if I take 101 parts by weight of nitre, and 98 parts by weight of sulphuric acid, I shall get exactly 63 parts by weight of nitric acid, and that no nitre or sulphuric acid will be wasted; and you will easily understand that these numbers enable you to calculate the quantity of the materials you must take to get any given weight of the acid. Suppose you wanted 10 pounds of nitric acid, how much sulphuric acid and nitre would you need to employ? Well, if you wanted 63 pounds of nitric acid, you would need 98 pounds of sulphuric acid and 101 pounds of nitre, and, of course, in order to get 10 pounds you will need $\frac{10}{63}$ of 98 pounds of sulphuric acid, and $\frac{10}{63}$ of 101 pounds of nitre. So that all calculations of this kind are matters of simple proportion.

Let us take one other example. We made hydrogen by acting upon zinc with sulphuric acid and water (Experiment 15). The change which here takes place is represented by the equation—

$Zn + H_2SO_4$	=	$H_2 + ZnSO^4$	or
Zinc and sulphuric Acid	yield	Hydrogen and Zinc Sulphate	
65 and 2 + 32 + 64	yield	2 and 65 + 32 + 64	or
65 and 98	yield	2 and 161	
parts of Zinc, parts of Sulphuric Acid		parts of Hydrogen, parts of Zinc Sulphate	

This means that if I take 65 pounds of zinc and 98 pounds of sulphuric acid, I must always get 2 pounds of hydrogen gas, and 161 pounds of zinc sulphate. If I ask you how much zinc and sulphuric acid must you take in order to get 40 pounds of hydrogen, I am sure you will all be able to tell me.

In like manner every chemical change, as soon as we understand it, can be represented by a formula, or set of symbols, which tells us exactly what happens, and how much of each of the various materials must be taken, and how much of each of the several products are formed.

It is the business of the chemist to seek out and determine the nature of all new chemicals which may be observed, and he does this with zeal and confidence, because he knows that if he has once determined with care the nature of the change, and if he has once ascertained the proportions by weight in which the elements or compounds take part in it, he has settled this particular question for ever, as the same chemical combination always takes place according to the same unchanging laws.

The book on Physics is of the same instructive character as that on Chemistry—one is in no degree behind the other. This treatise is a definition of physics, of motion, of force, of gravity, of cohesion, of chemical attraction, and the uses of these three forces are stated; and we are taught how gravity acts; then come the three states of matter, with definitions of solids, of liquids, of gases, their properties being fully shown; moving bodies, vibrating bodies, heated bodies, and electrified bodies are afterwards dealt with.

The following quotation will afford a fair sample of the mode in which Professor Stewart handles his subject:—

CONVECTION OF HEAT.—If we take a vessel full of water, and float on its surface a vessel full of boiling oil, we shall find that the heat of the oil will be conducted very slowly indeed downwards through the liquid; in fact, a few inches

* The number below the letter applies to that letter only.

down the rise of temperature will be hardly perceptible. But if instead of heating the vessel with water in it from above we heat it from below, we shall find that in a very short time the whole water will be heated and begin to boil. In fact, as we have already stated, the heated particles getting lighter rise, and are replaced by colder and heavier particles from above, so that we have a current, the heated water ascending in the middle and the cold water coming down the sides.

We have several good examples of convection in nature; for instance, in a lake which is cooled at its surface by the action of intense cold. The surface particles are first cooled, and getting heavier, they sink down, and are replaced by lighter and warmer particles from beneath, so that in a short time the whole body of water becomes cooled down to a temperature about 4° above the freezing-point; after that temperature the water, contrary to the usual practice of things, expands when further cooled instead of contracting; and when ice is formed, this ice, being decidedly lighter than water, floats on the top.

Now, had ice been heavier than water, it would have fallen down to the bottom as it was formed, a fresh surface would thus have been exposed, and the whole lake would soon have become one mass of ice. But as it is, the cold can only freeze the second layer of water through the ice of the first, and this is a very slow process, so that there is no danger of a lake being permanently frozen.

In the air again we have strong convection currents due to heating; for it is on this account that the hot air of a fire goes up the chimney, being replaced by cold air from the room, and we have the very same thing on a large scale in the great system of winds, for at that part of the earth called the equator, where the sun is most powerful, the air when heated mounts up just as the air of a fire mounts up the chimney. This air is then replaced by currents blowing along the surface of the earth from the poles or colder portions of the earth. We have thus at the equator a system of upward currents which carry off the hot air to the poles in the upper regions in the air, and we have also currents blowing along the surface of the earth which bring back this air when cooled to the equator. These surface-currents blowing from the poles to the equator are called the trade winds.

The illustrations in both Primers, as in the above, have reference to experiments which in school teaching should be used for the instruction of the pupils. As we strenuously advocate the teaching of practical science with a view to technical education, we wish God-speed to this Science Primer movement.

Beeton's Science, Art, and Literature.—A Dictionary of Universal Information, comprising a complete Summary of the Moral, Mathematical, Physical, and Natural Sciences; a Plain Description of the Arts; an Interesting Synopsis of Literary Knowledge, with the Pronunciation and Etymology of every Leading Term; containing Nineteen Hundred and Eighty Columns, and upwards of Six Hundred Engravings. Vol. I. London: Ward, Lock, and Tyler.

To originate works of pleasurable and profitable reading is an object aimed at by the majority of those persons who enter upon a literary career. Few of these, however, would treat with anything but derision the advice that they could best do this by compiling a dictionary; yet the book before us is full of as pleasant reading and sound information, conveyed by means of woodcuts and lithographic prints, as any book can be. Indeed, it has only one little difficulty—bulkiness—standing in the way of its becoming the constant companion of those who would like to use odd hours to acquire knowledge without the mental fatigue involved in what is termed the "dry reading" which is the staple commodity of books of scientific and useful knowledge.

In addition to the ordinary information expected to be found in a dictionary, this work affords detailed statements, illustrated in some cases by small woodcuts, in others by lithographs of full-page size, of various matters of art and science. Thus we have bridge construction, furnaces, architecture, and many other subjects treated of in the present volume, which does not extend beyond the letter G. The comprehensiveness of the work will be readily appreciated when we state that not only art and science, but law, are dealt with in the same ample manner. The soundness of the work will be easily understood when we state that many of the subjects are extracts from standard works, so that you here have a cycle of arts, sciences, and general information in A B C form.

New Theory of the Figure of the Earth, considered as a solid of Revolution; founded on the direct Employment of the Centrifugal Force, instead of the common principles of Attraction and variable Density. By William Ogilby, Esq., M.A. Trin. Coll. Camb.; Fellow of the Geological and Zoological Societies of London and Dublin; Member of the Royal Irish Academy, etc., etc. London: Longmans, Green, and Co. 1872. [Second notice.]

The following are some of the principal fallacies and hypotheses invoked in this artificial mode of treatment, for the purpose of making the analytical results in some degree conformable to phenomena.

First: whilst it is universally acknowledged that the spheroidal figure is due to the action of the centrifugal force, the efficient cause of the phenomenon is sedulously ignored in the investigation of its effects, and the question treated on the principle of attraction, as if it was a case of elliptic motion.

Secondly: this pretended attraction, though professing to be the resultant of the individual attractions of all the particles, must not be confounded with terrestrial gravity, inasmuch as gravity varies *directly* as the square of the sine of the latitude, acts in the normal, and is consequently directed to a different centre at every point on the surface, whilst the assumed attraction tends to a fixed centre of force, and varies *inversely* as the square of the distance. Besides which, Kepler's laws of the equable description of areas, and the variation of the square of the time as the cube of the distance, apply to the one, but have no reference to the other.

Thirdly: in order at once to provide this required centre of attraction, to furnish data for computing the equilibrium of the polar and equatorial seas, and to account for the formation of the intertropical meniscus, the earth is conceived to have been originally a homogeneous fluid sphere, having its ponderable matter collected in the centre of gravity, and the fluid particles capable of being transported from the pole towards the equator.

Fourthly: but since it is notorious that the earth is not a homogeneous sphere, but a heterogeneous spheroid, and that the gravity or mutual attraction of its particles, instead of tending to a common centre, acts at every point in the normal or perpendicular to the surface, subsidiary hypotheses are imagined for the purpose of evading the incongruity, and making the analytical treatment of the problem more conformable to phenomena.

Fifthly: for this purpose, though the centrifugal force, like the rotatory motion which produces it, is developed in parallels of latitude, from west to east, the fact is ignored in the common treatment of the problem, and the motion tacitly assumed to take place in the meridian, in which direction the modification of figure occurs.

Sixthly: and, consequently, since the centrifugal force is only developed in a circle, the terrestrial meridians are assumed to be but little different from that curve; and the products and powers of small quantities inconsistent with that supposition, are unhesitatingly neglected *for the purpose of facilitating* the investigation.

And, lastly: the whole question is thus removed from the domain of philosophy into that of algebraic analysis, and the phenomena of physical reality subordinated to the conditions of abstract relations.

Yet in spite of all this cooking and manipulation, mathematicians are obliged to confess that they have not succeeded in solving the problem of the figure of the earth. "It is true," says Clairaut, "that we cannot tell how the earth and planets come to assume their spheroidal figure; but is it not sufficient to know that they can maintain it?" And this evasion is sanctioned by all subsequent writers. Laplace concludes his elaborate investigation with a similar confession. "We may deduce from the preceding analysis," says he, "this important conclusion, namely—that we can affirm that the equilibrium is rigorously possible, *though we cannot determine the precise figure which will satisfy it.*" Humiliating admissions these to be extorted from mathematicians who believe in the omnipotence of analysis, and look down with supercilious contempt on all other processes of philosophical reasoning. Yet both Laplace and Herschel, though treating the problem on that principle, distrust the accuracy of their results, and hesitate to believe that the earth is a spheroid of equilibrium at all; whilst Playfair even appeals for aid to the Huttonian geology to repair this original oversight of the great Architect of the universe. Verily, King Alphonso was not the only philosopher whose advice ought to have been called in at the creation. Such is the consequence—one among many hundreds of similar instances in philosophy—"of the fondness and towering pride of mathematicians, who will have their science preside over physics," and insist on treating mixed philosophical questions by pure analytical principles. It is high time that mathematicians should moderate these unwarrantable pretensions, understand that the laws of nature do not depend on the integration of a differential co-efficient, or the solution of a transcendental equation, and learn that there are more secrets in nature than are comprised in the analytical shibboleth $\frac{dy}{dx}$.

This confusion between mathematical and physical reasoning is often carried to such a ludicrous excess as to outrage all common sense. A late esteemed friend of my own, one of the most eminent analysts of our age and country, writing to me on the very subject of this memoir, observed—"Dear O., you don't give sufficient credit to the power of mathematics: a mathematician can make the earth rotate about the dome of St. Paul's." To which I replied, with equal brevity, "Dear D., if a mathematician can do what you say, he can do more than nature ever pretended to." I knew what my friend meant, but we started from different premises, and could never arrive at the same conclusion. A similar fallacy had been committed by Dr. Lardner, during the once celebrated moon controversy which was carried on in the *Times* newspaper some twelve or fifteen years ago, who publicly stated that the earth did actually rotate about the peak of Teneriffe once every twenty-four hours.

Another absurdity of the same kind will be sufficient for the present to show the preposterous extravagance of mathematical pretensions. Poisson had long since examined the effect of the attraction of the sun, moon, and planets to change the position of the earth's axis of rotation in the interior of the spheroid; subsequent French mathematicians discussed the same question, and it has recently been made the subject of an express treatise to introduce it to English analysts. Yet what is the real question at issue? Attraction only takes place between material bodies which can act and react on one another. The heavenly bodies are certainly such material globes as can obey these conditions, but the terrestrial axis of rotation is a mere geometrical line—an abstract conception which can neither attract nor be attracted; and yet this absur-

dity is made the subject of an elaborate analytical investigation. As well might mathematicians pretend to ascribe the phenomena of the earthquake and volcano to the attractions of the heavenly bodies; or, rather, with better reason, since all the phenomena concern concrete matter.

Now there can be no doubt that the crude and mistaken ideas of physical philosophy so prevalent among the semi-educated classes at the present moment, and the pantheistic materialism thereby engendered, arise in a great measure from the unintelligible form in which the results of science are presented to them, and the implicit faith which the cultivators of other departments of philosophy accord to the presumed demonstrations of applied mathematics. One of my principal objects in the present memoir, accordingly, has been to draw philosophy down from the misty regions of mathematical abstraction to the solid basis of physical reality; to interpret the symbolical hieroglyphics in which analysts are accustomed to conceal their ideas into the sober language of common sense; in a word, to translate the bible of science into the vulgar tongue, in which every man can read and understand it, without gloss, comment, or interpolation. This is the most effectual method of counteracting the rash and ignorant attempts which have been made to substitute a godless pantheism for both natural and revealed religion, to dissociate the universe from its Creator, and resuscitate the defunct goddess of reason which the indignation of outraged society dethroned and buried some eighty years ago

The foregoing observations are not intended to deprecate mathematical reasoning on physical subjects. My object has been to deprecate the *abuse*, not to prohibit the *use*, of this noble science in its application to the properties of concrete matter; to employ it, according to the recommendation of Bacon, and in imitation of Newton, not as the mistress, but as the handmaid of physics—not as the maker of the laws of nature, but as their humble interpreter.

The principles of the method here proposed for treating the problem of the figure of the earth are extremely simple I make no hypothesis of any description, nor require any other data than those which are furnished by observation and experience. Starting from the admitted phenomenon that the earth is a heterogeneous solid whose mean density, magnitude, and periodic rotation are known quantities, I thence proceed to examine the action of the centrifugal force in producing its present figure, determining the law of gravity at its surface, the variation of curvature, the length of the terrestrial axis, and the change of local ellipticity at every point on the surface; with other phenomena relating to its present and original structure and condition. This mode of treatment furnishes definite results without doctoring the process either by the introduction of extemporised assumptions, or the rejection of unmanageable quantities.

These views the author proceeds to elucidate with considerable ability, but the correctness of his views we must leave to the consideration of such of our readers as consult the book.

A Sketch of various Plans which have been proposed as a Means to effect Puddling by Machinery, the Causes of Failure Pointed Out, and the Probable Solution of the Difficulty Suggested. By WILLIAM YATES. With Appendix. London: Vacher and Sons, 29, Parliament Street (Re-issue 1872.) [*Continuation of notice.*]

SINCE the accompanying sketch was printed, and waiting for distribution until my foreign patents were secured, I have had the opportunity of perusing Mr. Menelaus' paper on "Mechanical Puddling," read in Paris on the 5th June, 1867, before the members of the Institution of Mechanical Engineers, and since published in the records of their proceedings.

As Mr. Menelaus confirms much that I have stated, and admits with all other speakers on the subject that it is *only a suitable lining which is now required to make mechanical puddling a complete success*, and as all admit the importance of the subject, I venture to reprint from the volume of the "Transactions of the Institution of Mechanical Engineers, Proceedings, 4th, 5th, and 6th June, 1867," the following extracts —

"The chief difficulty in puddling in revolving vessels is to *get a lining* which will withstand the chemical action of the melted metal and cinder, and the mechanical action of the iron from the time it comes to nature until it is balled up"

"The linings were put in in various ways. *Sometimes the material was used in its natural condition, as in the case of the titanic ore* [titanic iron ore not "melted in" as specified by me], and sometimes it was reduced to powder, tempered, and rammed round a core, and then carefully dried *in situ*. In other cases the ground material was made into bricks of the proper size and form to fit the vessels, and these were burnt in the usual way, and set carefully in the vessel with cement, generally of the same material.

"Some of the substances tried for lining, from which better results might have been expected, failed signally; in this class were 'bulldog' and 'puddling ore.' As soon as it was known that experiments were being made at Dowlais on a large scale, suggestions were sent to the writer from all quarters, mostly from England, but many from the continent of Europe, and some even from America. The writer may fairly say that he gave every feasible suggestion a fair trial when it was practicable to do so. A lining of iron in imitation of the common puddling furnace was a favourite plan with many, and to test it the writer had a vessel lined with *iron bars* (ordinary wrought iron bars), placed on edge in the longitudinal direction and firmly secured to the vessel, the spaces between the bars were filled and rammed hard with one of the best lining materials. The bars were for the purpose of preventing the lining from being abraded by the action of the granular iron in the course of puddling; and it was hoped that the lining in its turn might prevent the iron from adhering to the edges of the bars. As was feared, however, the iron stuck fast to the bars wherever their edges were exposed, *to such an extent that in one instance the whole heat adhered to the sides of the vessel As far as the writer's experience goes, it is next to impossible to prevent the puddled iron from adhering to the clean surface of an iron lining, heated to the temperature necessary for puddling.*"

. . . "And this is the great difficulty still to be solved—the quality was wonderfully uniform; there was no bad puddling in the ordinary sense, the iron being all perfectly and uniformly worked."

. . . "And improve what is perhaps the most important process in the iron manufacture—a process that appears likely to hold its ground in some form or other for very many years, inasmuch as it is the only method at present known by which on a large scale the great bulk of the pig iron made can be converted into malleable iron or steel."

"It seems not improbable, indeed, that the Bessemer process, even yet in its infancy, may owe its full development to puddling; for it has already been practically demonstrated that steel of excellent quality can be made from common pig iron purified by the puddling process, and therefore the expense of puddling seems to be the only obstacle in the way of its application for preparing common pig iron for the Bessemer converters.

"Looking at the subject of iron manufacture as a whole, there appears to be *no commercial question at the present time of so much importance to the world at large as that of cheapening the mode of purifying crude iron.* At present this is effected by such a combination of high skill and *severe manual labour* as can only be purchased at great cost; and this cost will doubtless go on increasing unless something is done to lighten materially the labour of the puddler, and so render his occupation more endurable. In England it may be said that the extension of the iron manufacture is limited by the supply of labour in this particular branch; and there are serious doubts whether under any circumstances the supply will keep pace with the demand."

Mr. C. W. Siemens remarked—

"He was satisfied that any improvement such as the one now described, which could dispense with the toilsome manual operation at present prevailing, would be of very great value."

"In his own trials of puddling furnaces he had found that the particular part where the lining failed was all along the line of the surface of the melted iron, and in the revolving puddling vessel now described *that line was continually changing.*"

"The question of commercial economy was perhaps of secondary importance in comparison with the primary consideration of the practical success of the process for the manufacture of iron; and *the mechanical arrangements for performing the operation of puddling appeared certainly to be well carried out*" (long before Danks came upon the scene).

Mr. Menelaus said—

"That the first object which he had aimed at in the endeavour to accomplish mechanical puddling had been to obtain a good result in regard to the quality of material produced before attending to the question of commercial economy; but he must frankly admit that all the attempts which had been made at the Dowlais Iron Works during several years past had not yet resulted in success, and so far indeed was the process described in the paper from proving yet a practical success, that at the present time the puddling machines were all standing idle. The importance of lightening the puddler's labour was very seriously felt at Dowlais, where there were as many as 150 puddling furnaces to be kept constantly at work; and great difficulty had been experienced in finding regularly a sufficient number of men to work so large a number of furnaces. If the laborious part of the process could be lightened, men could more easily be got to perform the rest of the work, but there were so many conditions essential to successful puddling, that it was extremely difficult to substitute mechanical agency for the present manual labour."

"*One man attended to a pair of vessels, and each vessel turned out six heats per day.*"

The President, Mr. John Penn, enquiring, said—

"He supposed *it was the question of lining* which would principally determine the ultimate success or failure of the plan of mechanical puddling now described."

Mr. Menelaus replied—

"That he attributed the present failure of the attempt SOLELY *to the failure of the lining* in the puddling vessel; the chemical action of the melted metal and cinder, together with the mechanical action of the iron in its granular state, soon wore the lining away, and it got mixed with the iron, which was consequently rendered inferior in quality; little or no injury was done to the lining by the rolling of the iron when balled up."

Mr. E. Williams said—

"He had seen the puddling machines at work at Dowlais, and he was at a loss to understand why there should be any more difficulty in watching the process and regulating the heat during the whole of the operation than there was in the ordinary puddling furnaces. There appeared to him to be quite sufficient facility for seeing the metal through the door in the fluebox; and for regulating the heat the puddler could have recourse either to the damper or to the fire itself. While witnessing the experiments at Dowlais he had been much struck by the very efficient stirring produced by the revolving puddling vessel, which was better than any stirring by the ordinary mode with a rabble."

"*The lining of the puddling vessel was at present* THE ONLY *failure; and all the mechanical arrangements appeared very good.*"

Mr. E. W. Richards said—

"He fully concurred in considering the results thus far arrived at as most satisfactory, THE ONLY *serious difficulty that yet remained being the lining* of the puddling vessel."

Mr. E. Riley said—

"With regard to regulating the heat and watching the process of puddling, he thought those points were as successfully attained in the revolving puddling vessel as in an ordinary furnace. THE REAL *difficulty at present was the lining;* and when that had been successfully overcome, any further points could then be considered that might require attention."

Mr. I. L. Bell remarked—

"One very encouraging feature therefore of the trials at Dowlais was *the remarkable uniformity* which was stated to have been experienced in the quality of the iron produced."

"*The uniformity in the quality must be looked upon as a point of much importance,* because it might fairly be expected that, when the difficulties which now beset the process were ultimately overcome, means would thereby be arrived at of producing a good quality of iron with more complete uniformity than was possible in the present condition of the iron manufacture."

"With regard to the construction and working of the revolving puddling vessel, he did not see any reason why the control of the operation should not be quite as easy in the case as in an ordinary puddling furnace, *as soon as means were devised of maintaining the vessel in working order.*"

Mr. Menelaus observed—

"*The remarkable uniformity obtained* in the quality of the iron puddled in the revolving vessel he considered was to be attributed to the fact that *a machine was neither lazy nor dishonest;* and therefore the same amount of work was always put into the metal, and the result was perfectly uniform. In hand puddling, on the contrary, it was often found that portions of badly puddled iron had been wrapt up in the ball by the puddler: and there were great variations in the quality of the iron produced."

"He had not tried graphite for lining the puddling vessel, he had tried ground coke and tar, but with only very partial success, and had therefore abandoned the idea of looking any further in that direction. The experiments he feared had exhausted almost every material that appeared likely to succeed; but now that general attention was directed to the subject *he hoped something might ultimately be devised which would answer the required purpose.*"

"*He found the simple rotary motion produced quite sufficient effect in working the iron* in the vessel, and he considered this plan was most likely to prove ultimately successful."

"*He believed the plan was a great success as far as it went,* but he thought it did not go far enough, as it did not ball up the iron at the completion of the puddling. His own object was to do away with the puddler's labour altogether, so as to enable one skilled workman to manage three or four furnaces simultaneously. Where great skill and great bodily labour were required in combination, high wages were inevitable; and unless some scheme could be devised for doing away with the hard work in puddling, *he did not know where men enough would be got to perform the work,* or how the manufacture of iron would ultimately be carried on."

The President, in summing up, "hoped he (Mr. Menelaus) would not relax his efforts in endeavouring to attain the important object in view. There was no heavier kind of work than that of the puddler, for which consequently it was necessary to pay very dearly; and it was therefore highly desirable to lessen the amount of that labour, *and leave the puddler to look on and exercise his skill only in the control of the process.*"

I should recommend all interested in this subject to obtain a copy of Mr. Menelaus' paper in a complete state; it will well repay careful consideration.

After having read the foregoing extracts I venture to beg the reader in the next place to refer to pages 6 and 7 of my paper, where he will find (page 6) *that as long ago as* 1861 Mr. Braithwaite reported "*the mechanical arrangement of the* (Tooth's) *machine as practically complete, simple, and good,*" and I fail to perceive that the process even now has advanced one step beyond that point. The suitable material for a lining there alluded to (page 7) was a particular kind of fire-brick, and not my present recommendation, viz., malleable cast iron, fettled with iron cinder, scale, titanic iron ore, &c., as I specified in 1868.

Since I read Mr. Menelaus' paper, finding that bars of wrought iron do not answer on account of the charge welding itself to the lining, I have disclaimed the use of them. My hope of success with malleable cast iron linings is based on this theory. Cast iron, having been deprived of its carbon, or its element of fluidity, becomes malleable cast iron, and will only melt at a very high degree of heat, and it is practically unweldable, therefore I hope with confidence that my material will both stand the necessary heat, and also that the charge will not adhere to the lining.

As a simple method of testing these two points I would first try some rabbles made of malleable cast iron and would have them used for puddling in the ordinary furnace, and if these bear the heat in puddling several charges without melting, and without the iron sticking to them, I would next proceed to try a bottom of an ordinary puddling furnace made of blocks of malleable cast iron* but, perhaps, in the mean time I may be able to induce either Mr. Menelaus or Mr. Williams to try my lining in combination with a revolving puddling machine, and so settle at one and the same time the question both of the lining and of the "Churn" in practical joint operation, and if successful I shall have overcome the last impediment to puddling without manual labour, and have solved the problem of puddling iron by machinery.

A Manual of Chemical Physiology, including its Points of Contact with Pathology. By J. L. W. THUDICHUM, M.D. London: Longmans, Green, Reader, and Dyer, Paternoster Row. 1872.

THIS is a medical book, and, judging from its chemical information, which is what we understand best, the work is fully equal to Dr. Thudichum's high reputation as a man of science.

It appears the first part of this little treatise was written and printed as the introduction to Dr. Thudichum's "Researches intended to promote an Improved Chemical Identification of Diseases," published in several numbers of the annual "Report of the Medical Officer of the Privy Council." It is an epitome of the branch of science commonly termed "physiological or animal chemistry," and will be found to contain its latest acquisitions. Medical students who possess the information it contains will be enabled to meet the requirements, so far as concerns this particular subject, of any of the examining and licensing bodies in this country and abroad. To the student in Chemistry, Physiology, or science, it offers a ready help to the acquisition of elementary knowledge, upon the basis of which he can afterwards place the superstructure of more extended and detailed studies. To the medical profession it will afford an easy bird's-eye view of the chemical feature of the field of their thoughts and action. Its perusal will involve no unreasonable tax upon the time of any reader or student, and occasional reference to particular points is facilitated by marginal notes and a short alphabetical index.

An "Analytical Guide" forms the second part of the work, intended for the use of those who desire to make themselves practically acquainted with the phenomena and constituents of animal bodies. It is not descriptive in the sense in which ordinary chemical text-books may be said to be so, but *prescriptive* in the style and manner of pharmacopœias, directing students how to proceed in order to arrive at a certain result, and leaving them in most cases to appreciate the result of an operation by their own reflection.

Dr. Thudichum states that this little treatise summarises much of the method pursued and many of the results arrived at in his laboratory during many years of patient inquiry. He states that, in the compilation of the Analytical Guide he has received much valuable help from his esteemed assistants, Mr. F. J. M. Page and Mr. C. O. Stewart, for which he expresses to them his sincere thanks.

The following statements are of general interest:—

The food of man, variously prepared by mechanical processes and chemical operations (cooking), is comminuted in the mouth by chewing. At the same time it is mixed with a variety of fluids, some of which have chemical powers and predispose the food to a change, while others serve mechanical objects only. The mixture of these fluids is termed saliva, but however homogeneous may appear that mixture, the proportions of its components are very various. For the secretion of every particular kind of glands, of which there are four, differs, and the secretion of one and the same gland or set of glands may vary according to the agencies which call them into action. Underneath the forepart of the tongue is secreted from one and the same duct the saliva of a gland which lies under the tongue (sublingual), and that of two other glands which lie farther back on both sides of the tongue underneath the lower jaw (submaxillary glands). To collect either of these secretions little tubes have to be carefully introduced into the respective ducts, which is a matter of some difficulty. For this reason the chemical composition of the secretions of the separate glands is very imperfectly known. Experiments upon animals have shown that these glands can give four different kinds of secretion, according to the nerves which are irritated for the purpose. One nerve, a branch of the facial, and a continuation of the chord of the tympanum, on irritation causes a clear, slightly ropy secretion from the submaxillary glands. This "chordal" saliva contains about 4 per cent. of solid matters, of which 1·5 are globulin, mucine, and coagulable albumen; 2·5 per cent. are mineral, mainly alkaline chlorides and lime-salts; of these latter the carbonate, dissolved in excess of carbonic acid, frequently decomposes in the mouth, and deposits crusts of lime carbonate upon the teeth, which are popularly called tartar. On irritation of the sympathetic nerve the submaxillary glands secrete an opaque, very tough saliva. This contains from 15 to 28 per mille of solids, amongst which is mucine, and granules or roundish lumps of an albuminous matter, and much free alkali. The third kind of saliva is that which flows when the submaxillary ganglion is made the centre of a reflex action which works by way of the lingual nerve. This is the only secretory act without the intervention of cerebro spinal influence that is known at present. The fourth kind of saliva is the "paralytic" or thin watery fluid which is secreted under the influence of nervous paralysis, caused either by degeneration, or poisoning, or wounds which separate the secretory nerves. Its composition is not yet ascertained.

Elements of Chemistry, Theoretical and Practical. By WILLIAM ALLEN MILLER, M.D., &c., late Professor of Chemistry in King's College, London. Revised by HERBERT McLEOD, F.C.S. Part I., Chemical Physics. Fifth Edition, with Additions. London: Longman, Green, Reader, and Dyer. 1872.

THE editor of this new edition of Dr. Miller's well-known work states that in placing a new edition of Dr. Miller's Chemical Physics before

the public so soon after the lamented death of the illustrious author, it was thought advisable to leave the edition of 1867 as far as possible without alteration. The rapid progress made by recent research in some departments of physical science has, however, necessitated some additions, of which the most important will be found in relation to solar chemistry, and the development of the theory of atomicity. These additions give increased value to a valuable work.

The work has been revised throughout, but as it does not profess to be a complete treatise on physics, and, in fact, mainly deals with physical science in its relations to that of chemistry, special attention has been paid to the subject-matter which is particularly interesting to students of the latter science.

A Monograph of the British Graptolitidæ. By Henry Alleyne Nicholson, M.D., D.Sc., &c. William Blackwood and Sons, Edinburgh and London. 1872.

The author states that the present work is the first instalment of a detailed monograph of the Graptolites of Britain, for which he has been engaged in collecting materials for some years. It is intended to serve as an introduction to the study of the *Graptolitidæ* generally; and he has, therefore, where necessary, introduced any important considerations which at present are to be derived from foreign sources alone.

The work is, in the main, based upon Dr. Nicholson's own private collection, which, it appears, exhibits more fulness in some departments than in others, whilst there are points in which he says he has had to rely entirely upon the observations of others, and records the great obligations he feels himself under to the published writings of Professor James Hall and M. Joachim Barrande.

Many of the illustrations are claimed as original, and are drawn from specimens in the author's own collection. The source of others is acknowledged in the text, and in this connection he expresses his thanks to Sir William Logan, F.R.S., who most liberally placed at his disposal all the engravings which were used by Professor Hall in his Monograph of the Graptolites of the Quebec Group (Decade II of the Geological Survey of Canada).

The remaining portions of the work will treat of the British species of Graptolites in detail, and will be successively issued as leisure will permit.

Technical Educator; An Encyclopædia of Technical Education. Vol. III. London: Cassell, Petter, & Galpin.

In the present, which is the third volume of this excellent work, we have continuations of most of the subjects contained in the preceding volumes, such as Civil Engineering, Mining and Quarrying, Fortifications, Chemistry, Technical Drawing, &c., together with additional subjects, amongst which are Capital and Labour, Map and Plan Drawing, Photography, Silk Culture, and Soldering, &c. In the biographical sketches of eminent inventors which are continued through this volume, are the lives of (amongst others) John Rennie and Thomas Telford, the great engineers, Mushet, the steel inventor; and Matthew Boulton, the partner of Watt. This volume is quite equal to those preceding it in regard to the typography and illustrations, the printed matter being profusely illustrated by well-executed engravings.

Esse and Posse: A Comparison of Divine Eternal Laws and Powers, as generally indicated in Fact, Faith, and Record. By Henry Thomas Braithwaite, M.A. of Cambridge, and of the Honorable Society of the Inner Temple. London: Longmans, Green, & Co. 1872.

The following, which we take from the introduction of this work, will give our readers an idea of its scope and object:—

From a belief that the pedigree recently constructed for man looms painfully between many of us and the Living Light, like the shadow of some Titanic simiad projected against the sun in his meridian splendour, I have endeavoured to reason it away. And inasmuch as miracles, in their customary acceptation, tend rather to overcloud than to enhance the true spirit and force of Christianity, the sublime ideality of whose Author the age takes too little into account, I have sought for them an interpretation free from the materialism which seems to underlie the religious theories maintained on the subject.

Whether the author has succeeded in the objects he proposed to accomplish we must leave to the consideration of such of our readers as may peruse his book. We cannot find space for any quotation, having too much matter of applied science pressing on us. All we can say is, that deep thought enunciated in a readable way characterises this work.

Conversations on Natural Philosophy, in which the Elements of that Science are familiarly explained and adapted to the comprehension of Young Persons. By Mrs. Marcet. Revised and Edited by the son of the Author, Francis Marcet, F.R.S. Illustrated with Plates. Fourteenth Edition. London: Longmans, Green, & Co. 1872.

In this new edition of the "Conversations on Natural Philosophy," two additional conversations are introduced on "Spectrum Analysis, and Solar Chemistry," the object of which is to give a clear, though necessarily a very incomplete, notion of the wonderful discoveries made recently on a subject which at the present moment so peculiarly engrosses the attention of the scientific world. The present editor states that it is due to the distinguished Professor of Chemistry, Mr. Henry Roscoe of Manchester, to state that his book on spectrum analysis, the only complete elementary work on the subject hitherto published either in this country or in France, has been the principal, if not the main source, from which these new conversations are derived, the translation of Professor Schellen's work on the same subject not having appeared until the revision of this volume had been completed.

Considering the well-deserved reputation Mrs. Marcet's work has obtained, and the eminence of the present editor, our readers will believe us when we say that this new edition creditably sustains the high reputation of this work in the midst of the additional knowledge and scientific advancement of the present day.

NOMINAL HORSE-POWER OF STEAM ENGINES.

The following correspondence on the above subject has been communicated to us by the Hon. Secretary of the Institute of Naval Architects:—

"Board of Trade, Whitehall Gardens, 22nd March, 1872. Sir,—I am directed by the Board of Trade to enclose some copies of a memorandum on "horse-power" of steam engines. Representations have been made to the Board that the term "nominal horse-power" conveys no definite meaning. This term occurs in Section 5 of the Merchant Shipping Act 1862, of which a copy is enclosed. The Board of Trade will be glad to receive any observations on the subject with which the Council of the Naval Architects may be able to favour them. If some understanding can be come to on the point, a definition of the term might be agreed to which will be accepted not only by the manufacturers and users of engines, but by the Legislature in the event of the term "nominal horse-power" being retained when the statute is revised.—I am, sir, your obedient servant, (*Signed*) Thomas Gray. To the Secretary Naval Architects, Adelphi."

"Institute of Naval Architects, 9, Adelphi Terrace, London, W.C., 4th June, 1872. Sir,—In reply to your letter (M) of the 22nd March, in which you ask for certain advice with respect to the term "nominal horse-power," I am directed to inform you that the subject has been carefully considered by a committee of the Council of this Institution with the following results:—The committee were unanimously of opinion that the term "nominal horse-power," as at present ordinarily used for commercial purposes, conveys no definite meaning. They were also unanimous in considering that the proposals contained in Mr. MacFarlane Gray's pamphlet could not be recommended for adoption. The majority of the committee were of opinion that no formula depending upon the dimensions of any parts of the engines, boilers, or furnaces could be relied upon as giving a satisfactory measure of the power of an engine, and that even if the varieties of engines and boilers now in use could be comprised under one general expression for the power, the progress of invention would soon vitiate any such expression or formula. The entire abandonment of an old commercial standard such as "nominal horse-power," however inaccurate, must be a matter of considerable inconvenience, and accordingly great attention was given by the committee to the question whether that standard could not be amended and retained. Among the many plans considered not one received unanimous or even general approval. That which met with least objection was that the indicated horse-power, as ascertained on a trial trip, should be taken either as the nominal horse-power or as a basis for it, being divided by a suitable divisor. The committee were of opinion that for the purposes of the Act, if any standard at all of horse-power is to be used with reference to the engineers, it would be better to name 400 indicated horse-power, in place of 100 nominal horse-power. The committee were also of opinion that *all* engineers of coasting and sea-going ships should be required to pass some examination, and the Council think it desirable that this opinion should be communicated to the Board of Trade.—I have the honour to be, sir, your obedient servant, (*Signed*) C. W. Merrifield, hon. sec. To the Secretary the Board of Trade, Whitehall Gardens, S.W."

MECHANICAL CAT.

An American contemporary states that Leonard, of the Cleveland *Leader*, has invented a sheet iron cat, with cylindrical attachment and steel claws and teeth. It is worked by clockwork. A bellows inside swells up the tail at will to a belligerent size, and by a *tremolo* attachment causes, at the same time, the patent cat to emit all noises of which the living animal is capable. When you want fun, you wind up your cat and place him on the roof. Every cat within half-a-mile hears him, girds on his armour, and sallies forth. Frequently, fifty or one hundred attack him at once. No sooner does the patent cat feel the weight of an assailant than his teeth and claws work with lightning rapidity. Adversaries within six feet of him are torn to shreds. Fresh battalions come on to meet a similar fate, and in an hour several bushels of hair, toe-nails, and fiddle-strings alone remain. A friend of ours, a mortal hater of cats, suggests that this artificial animal might be used as a decoy in order to effect the wholesale slaughter of the congregated pussies.

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THE INVENTORS' INSTITUTE,

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LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY.

The Session 1871 72 is now ended.

SPECIAL NOTICE.

In addition to Mr. F. H. VARLEY's paper, which is duly reported in another column, we have to notice that at the last meeting of the Inventors' Institute Mr CARL MOLCHIM, of Hamburg, brought before the meeting his New Light. At other meetings of the Institute the Patent Laws have been the subject which occupied the attention of the members.

R. MARSDEN LATHAM, *Secretary*

Members whose subscriptions are now due will please to forward the same to the Collector, Mr. G. A. Stretton, 4, St. Martin's Place, Trafalgar Square, London

Monthly Notices.

New Light. — A New Work for Inventors and Entomologists. — The Tsetze.—The Astronomer Royal made a Knight of the Bath

MR. CARL MOLCHIM, of Hamburg, has recently introduced to the notice of the public a new compound oil of great purity and brilliancy, suitable for lighthouses, railway-train lighting, shipping, and lighting purposes generally. Mr. Molchim exhibited lamps in which this oil was burnt, at the last meeting of the Inventors' Institute, and the result was deemed eminently satisfactory. We hope to be able to present our readers with full particulars as to the composition of this oil in our next issue.

A new work for inventors and entomologists has been prominently introduced to their notice and that of the public by our contemporary the *Daily Telegraph*, in the following terms:—" How grateful would the whole world be to the man who could rid us of our insect plagues; who could free Algeria from her curse of locusts, France from her vine plague; who could discover a cure for those pests of the silk-worm grower the *muscardine* and the *gattine*: who could show us how to exterminate the wire-worm, and to check the potato disease; and, finally, who could protect the cattle of the African colonist from the terrible tsetze. It is strange that upon a little fly should hang the whole future of a vast continent—and yet, perhaps, hardly less strange than that a swarm of locusts should stop the march of an army. The entomologist, then, is no mere 'harmless maniac who goes about with a green net sticking big pins into little beetles.' He has, on the contrary, a noble prospect, if he devote himself to his science in the spirit of Bacon, endeavouring to hold Nature fast, as Ulysses held Proteus, until she has answered his minutest question. He can benefit and earn the gratitude of the human race not less than if he made two blades of grass grow where but one grew before. To open Central Africa to English colonisation would be an achievement as glorious as to discover the sources of the Nile. The crown will fall to him who first teaches us how to baffle the poisonous little tsetze. And this he will do who, full of the wisdom of the 'Novum Organum,' patiently and unweariedly interrogates Nature herself until she yields her secret. The riddle is no puzzle without an answer. Its answer is surely to be found by those who seek. And some of the most startling facts—the very facts in which it lurks hidden like fire in flint—are already waiting like ore to be cast into the crucible, that from them may be run the 'solid and pure form of truth, free from all dross of error.'" We think our contemporary asks too much when he calls for the *extermination* of these pests. We think he might be satisfied with measures of protection against their ravages and repressing their attacks.

The journal we have referred to thus graphically describes the nature and habits of the African tsetze above alluded to:—" It is a little brown yellow-striped fly, hardly larger than the tiny household pest which buzzes upon our window-pane, but whose sting is absolutely fatal. So subtle, so deadly is its poison, that—we read—'three or four flies will kill the largest ox.' Soon after the bite—which gives little or no pain, and leaves a barely perceptible puncture—staggering and blindness come on. The body swells to an enormous size. The coat turns rough. In a few hours follow convulsions and death. The symptoms revealed by dissection are those of blood-poisoning. The flesh is bubbled with air as if a dishonest butcher had attempted to blow it up; the fat is turned into a hideous, fetid, greenish oil; the muscles are flabby: the heart so soft that the finger can be thrust through it; the blood has almost disappeared, and what little is left is so thin and ichor-like that it barely stains the finger. And yet this virulent poison, under the effect of which horse and ox, sheep and dog, fall as if plague-stricken, is absolutely harmless to man, to wild animals, to the pig, the mule, the ass, and the goat. Livingstone, in spite of every care, lost by the tsetze fly forty-three magnificent oxen in a few days. Many large tribes, inhabiting districts infested by the scourge, can keep no domestic animal except the goat. And yet 'our children,' the great traveller writes, 'were frequently bitten, and suffered no harm: and we saw around us numbers of zebras, buffaloes, pigs, pallahs, and other antelopes, feeding quietly in the very *habitat* of the tsetze, yet undisturbed by its bite.' Stranger still is it that the poison of this insect should not affect the calf until it has left its mother. The cow dies; the sucking calf, standing at its side, escapes; the dog, fed on milk like the calf, is killed by a single sting. Facts so utterly irreconcilable as these made Livingstone for a long time doubt whether it was really under the bite of this tiny little fly that his oxen had sunk. His doubts, however, did not last long, and were due rather to the bewildering nature of the facts themselves than to any want of sufficient evidence in their support."

Her Majesty has made the Astronomer Royal, now Sir R. Airy, a Knight of the Bath. *Everyone* will acknowledge this an honour well deserved; but why should it be delayed so long? Knights of the Bath, or rather of an order of merit, ought to be multiplied amongst us; we have plenty of great inventors and men of science amongst us worthy of the honour.

The Inventors' Institute.

At the meeting on 23rd May, Mr. F. H. Varley read a paper on inventions relating to telegraphy, when Capt. J. H. Selwyn, R.N., presided, and commenced the proceedings with a few prefatory remarks; and after Mr. Varley had read the paper (which we print separately in another column), the Chairman invited discussion by stating that he considered the efficient and cleanly instrument referred to by Mr. Varley was a great improvement, and would lead to the more extended use of printing telegraphs, which everyone who carefully considered all the bearings of the questions of telegraphy would acknowledge to be a desideratum. He then requested Mr. Varley to explain the details of the apparatus he had referred to, and exhibit the working of such apparatus Mr F. H. Varley having, with the aid of his brother, Mr. Theo. Varley, complied with this request by referring to the very elaborate model instruments which were on the table, the Chairman invited the Rev. E. Highton, who was then present, to lead off the discussion

Mr. Highton remarked that it seemed to him there was nothing to discuss. The relay instrument described by Mr. Varley appeared to be very ingenious and efficient.

The Chairman suggested that the general question as to whether the present state of our telegraphic system and apparatus were satisfactory might be discussed.

Mr. Highton thought that the delicate gold-leaf instrument he had invented, which would work with a very weak current and bad insulation, and which he had made to work as a transcribing instrument, would facilitate the operations of telegraphy. He might state that he hoped to be able to record telegraphic motions by photography

Mr. Theo. Varley remarked that it was quite true that electricity can be conveyed through uninsulated wire, but the time occupied in working would be so much increased that its practical availability would be nullified.

Mr. Highton here explained that he never intended to do away with insulation altogether, but only intended to make an instrument that would act with bad insulation, and he considered the gold-leaf instrument, from having so little weight, and being so easily moved, would effect such changes that, whilst at present we cannot work more than 1000 miles in one stretch, by the gold-leaf instrument this might be increased to say 6000 miles.

Dr. Macgregor Croft would like to ask what form the electric current takes. From his observations he was led to consider that there was a "spirality" of direction of current.

Mr. F. H. Varley replied that Faraday entertained the notion of "spirality," but no experiment has proved it to be a fact.

Mr. Sharpe thought that the Institute was much indebted to Mr. Varley for coming before them as he had done this evening. When they contrasted the present system of electric telegraphy with the old semaphore system, which was as the country waggon compared with the racehorse, they must all admit that the subject was one of general, even national importance. He therefore moved a vote of thanks to Mr. F. H. Varley, and also to his brother, Mr. Theo. Varley.

Mr. Campin seconded and Mr. Carttar supported this motion, which was put and carried with general applause.

The Chairman, in summing up, remarked that the subject discussed that evening showed most clearly that, contrary to the nostrums of some members of Parliament and professed political economists, the labours of inventors were of importance to the progress of practical science.

The proceedings terminated with a vote of thanks to the Chairman, which was carried by acclamation.

Proceedings of Societies.

ZOOLOGICAL SOCIETY OF LONDON.

21st May, 1872, R Hudson, Esq, F.R.S., V.P., in the chair - The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of April, 1872, amongst which were a young female Baird's Tapir (*Tapirus bairdi*) from Nicaragua, and a Red-billed Flying Squirrel (*Pteromys magnificus*) from the Himalayas A letter was read from Dr. G. Bennett, F Z.S., of Sydney, N S.W., giving particulars of the habits of a pair of *Didunculus strigirostris* and of other birds living in the Botanic Gardens at Sydney Dr Bennett also mentioned that a pair of the Red-billed Curassow (*Crax carunculata*) had built a nest in one of the trees in the same gardens, and had hatched out two young birds, which at the time he wrote were doing well. Sir Victor Brooke, Bart, read a paper on the Royal Antelope and allied species of the genus *Nanotragus*. Mr. A. H. Garrod read some notes on the anatomy of the Huia Bird (*Heteralocha gouldi*), as observed in a specimen that had lately died in the Society's Gardens, and showed that this form must be referred to the family *Sturnidæ* A communication was read from the Rev. J. E. Semper, containing observations on the Birds of St Lucia, to which were added some notes on the species by Mr P. L. Sclater. A communication was read from Dr. J E Gray on the Sea Bear of New Zealand (*Arctocephalus cinereus*) and the North Australian Sea Bear (*Gypsophoca tropicalis*). A communication was read from Dr A Gunther, F R S, containing a note on *Hyla punctata* and *Hyla rhodoporus*. Mr. P. L Sclater read a paper on the species of Quadrumana collected by Mr Buckley in Ecuador, amongst which was a specimen of *Ateles fusciceps*, Gray, from the western valleys of the Andes. Dr Murie read a paper on the osteology of the Tody (*Todus viridis*) He showed that this form comes under the group of *Coccygomorphæ* of Huxley, and does not belong to the Passeres (*Coracomorphæ*). Its nearest allies are the Mot-Mots and Kingfishers, but it must stand as a group of itself (*Todidæ*), notwithstanding which it shows some osteological and other points of resemblance to the Fly Catchers (*Muscicapidæ*).

4th June, 1872, Professor Flower, F R S., V P, in the chair. -Mr. G. Dawson Rowley, F Z S, exhibited a specimen of *Zonotrichia albicollis*, which had recently been captured alive near Brighton, being the second recorded instance of the occurrence of this bird in the British Islands Mr. P. L. Sclater exhibited a specimen of the American Black-billed Cuckoo (*Coccyzus erythrophthalmus*) killed in Ireland. This specimen has been referred by Mr. Blake Knox to the Yellow-billed Cuckoo (*Coccyzus americanus*), and by Lord Clermont subsequently to the Black-billed species (*C. erythrophthalmus*). Mr Sclater remarked that there could be no question of the latter determination being correct. The Secretary communicated extracts from a letter received from Captain Henry Pain, of the s.s. *Scandaria*, on the habits of the Sea-Lion (*Otaria jubata*) and Fur Seal of the Falklands (*O. falklandica*.) Professor Owen, F.R.S., read a paper on Dinornis, being the nineteenth of his series of memoirs on this genus. The present communication contained the description of a femur, indicative of a new genus of large wingless bird (*Dromornis australis*, *Ow.*) from a post-tertiary deposit in Queensland, Australia. Professor Flower, F R.S, read a note on some points in the anatomy of the Two-spotted Paradoxure (*Nandinia binotata*), and showed that the cæcum is absent in this animal—contrary to the almost invariable rule which distinguishes the Arctoid subdivision of the Carnivora. A communication was read from Dr. John Anderson, F.Z.S., Curator of the Indian Museum, Calcutta, on the osteology and dentition of *Hylomys*. Dr. Anderson came to the conclusion that this form was most nearly allied to *Gymnura*, and belongs to the Erinaceidæ. Mr. E. T. Higgins, F.Z.S., read a paper describing some new species of shells discovered by Mr. Clarence Buckley in Ecuador. Mr. F. Moore communicated a paper by Captain Thomas Hutton on the Bats of the North-Western Himalayas, in which several new species were described. Mr. P L Sclater, F.R.S., read some additional notes on rare or little known animals now or lately living in the Society's Gardens. Dr. J. Murie, F.L.S., read a paper on the Indian Wild-Dog (*Cuon dukhunensis*); his observations being based on two specimens formerly living in the Society's Gardens. After noting points in their anatomy, Dr. Murie specially referred to the variations in the pelage and skulls which distinguish the four supposed species of the genus. These he was inclined to regard only as one species, viz., *C. primævus*, with geographical varieties. A second paper by Dr. Murie contained observations on the Bornean Ape (*Macacus maurus*), being the first of a series of papers on the rarer forms of this group.—The next meeting of the Society for scientific business, closing the session 1871-72, was held at the Society's House in Hanover Square, on Tuesday, the 18th of June, 1872, at nine o'clock, p m, when the following communications were made:—1. Dr. J. Murie.—On the cranial appendages and wattles of the Horned Tragopan (*Ceriornis satyra*, *Linn*) (Received 20th May, 1872) 2. Professor H. H. Giglioli, C.M Z S —On the Cetacea observed during the voyage round the world of H.I.M.S *Magenta*, 1865-68, with the description of several new or little-known species, and of a new genus of Fin-backed Whale. (Received 30th May, 1872.) The following papers remain on hand:—1. Dr. J Murie.—Observations on the Macaques II Belanger's Monkey, the *M. arctoides* of Is. Geoff, and *M. brunneus* of Anderson. (Received 29th May, 1872) 2. Dr. J. E. Gray.—Description of the younger skull of Steller's Sea Bear (*Eumetopias stelleri*) (Received 3rd June, 1872) 3. Rev. O. P. Cambridge.—Descriptions of twenty-four new species of *Erigone* (Received 4th June, 1872) 4. Dr. J. Murie.—Observations on the Macaques. III The Formosan or Round-faced Monkey. (Received 4th June, 1872). 5. Dr. J Murie.—Observations on the Macaques. IV. The Japanese Monkey. (Received 5th June, 1872.)

SOCIETY OF BIBLICAL ARCHÆOLOGY.

4th June, 1872, Dr. Birch, F.R.S., President, in the chair.—The following new members were nominated by the Council for election and were duly accepted:—Rev. Cators Chamberlain, M.A.; Rev. J. T. Fowler; Dr. Ch. Ginsberg; Rev. A. H. Johnson, M.A., Oxford; Rev. S. Savage Lewis, M.A., Librarian C. C. C., Cambridge; Rev. S. Sole; Rev. John Walker; John Eliot Howard; Joseph Mayer.

The following papers were then read:—

"On a Religious and Political Revolution which took place in Egypt prior to the Reign of Rameses III., having a probable connection with the rise of the Jewish Religion. From the text of the Harris Papyrus." By Dr. August Eisenlohr of Heidelberg.—After a short mention of this magnificent Papyrus, the property of Miss Harris of Alexandria, the learned Egyptologist stated that it contained an account of the reign of Rameses III. and the events preceding his accession to the throne. Among these he finds a most marvellous account of a politico-theological revolution made by a Syrian hero, who, after a period of general disorder, made himself chief of the whole country, and abolished the existing religion and the sacrifices then in use. The father of Rameses III., King Seti-nekht, suppressed this revolution and restored the country to its former religious institutions. The striking resemblance of this story with the narrative of the return of the Hyksos, which was extracted by Josephus from

Manetho's work, and was held by nearly all authorities to be connected with the establishment of the Jewish religion, is very remarkable. Dr. Eisenlohr considered these passages in the Harris Papyrus as representing the Egyptian view of this and other great events which were the immediate cause of the Exodus, in which case the Papyrus would constitute the first Old Egyptian document hitherto discovered to bear upon the subjects treated of in the Book of Exodus. And it is therefore an additional gratification to learn that the Trustees of the British Museum have recommended to the Treasury the purchase of this invaluable document.

"Observations on the Dimensions of the Great Pyramid and the Royal Coffer." By Solomon M. Drach, Esq., F.R.A.S., F.R.G.S.—In this paper, which consisted of a series of mathematical tables, the learned author produced some further curious and remarkable results illustrative of the geometrical ratios of the oldest structure in the world.

"The XXXVII Aamu in the Tomb of Chnum-Hotep, at Beni-Hassan, identified with the Family of Israel." By the Rev. Daniel H. Haugh, M.A.—In this elaborate paper the learned author maintained that the said group, representing 37 Aamu or Mestemmu from the land of Shu, depicted no other than the patriarch Jacob and the 36 legitimate members of his family (the offspring of his wives Leah and Rachel), who entered Egypt at Joseph's invitation, the concubines and their children, holding a decidedly inferior rank, and regarded as slaves and slave-born, not being counted, reducing the legitimate family of Jacob to that number. Shu he supposed to be "the Land" Mestemmu he compared with Beto-Mestham (Judith iv., 6), in the territory of Dothan, conquered by Jacob (Gen. xlviii., 22). In a supplement to this paper Mr Haugh described a Babylonian cylinder brought from Hidah, engraved by Mr Layard in his travels, and translated the cuneiform inscription as representing Terah and his children, Abraham, &c. The names Iscah and Milcah (Queen) he considered might perhaps be one name in duplicate, the result of a marginal gloss (one sign in the cuneiform writing representing the sounds *is* and *mil*).

VICTORIA INSTITUTE

The seventh annual meeting of the Victoria Institute was held on Friday, at the house of the Society of Arts, under the presidency of the Earl of Shaftesbury. Among those present were the Archbishop of York, the Earl of Harrowby, Bishop Claughton, Sir Donald M'Leod, G.C.S.I., the Hon. E. Ashley, Admiral Halstead, &c. Letters of apology were read from the Archbishop of Canterbury, Lords Lichfield and Mahon, the Bishops of London, Chester, Gloucester, Nottingham, Bishop Travers, Sir J. Hay, M.P., Sir Robert Lush, the Right Hon. Stephen Cave, M.P., and others. Captain F. Petrie read the report, which called attention to the propriety of raising the number of members, so that the Institute's sphere of action might be extended. A vote of thanks to the President was moved, seconded, and carried. In replying, the Earl of Shaftesbury stated that the Institute was now becoming more firmly established, and he trusted that one more known for scientific attainments would take the position he had held with so much pleasure to himself, and, he trusted, some advantage to the cause of true science.

INVENTIONS RELATING TO TELEGRAPHY. By F. H. VARLEY, F.R.A.S., Member of Council of the Inventors' Institute.

It is now a century and a quarter since the time that Dr. Watson, Bishop of Llandaff, made the famous experiments at Shooter's Hill, at the Thames at Westminster, and the New River at Stoke Newington, which showed that electrical discharges from a Leyden jar could be propagated through a distance of upwards of four miles without any appreciable loss of time (head of hair and pith balls). To these experiments England may justly refer with pride, being the foundation of all the systems of telegraphy. From the time that Dr. Watson's experiments became known they were repeated by others in various ways.

In 1750, three years later, Winkler at Leipsic discharged Leyden jars through long circuits, in some of which the river formed part. Lemonier, in Paris, produced shocks through 12,800 feet of wire; and it is claimed for Betancourt, at Madrid, the credit of first extending the circuit to 26 miles. Lesarge, in Geneva, established the first electric telegraph. It consisted of twenty-four wires, or as many as there were letters in the alphabet. The wires were each separately insulated, and each in communication with a small pith-ball electroscope, which were to be diverged with a small electrical machine, at the base of each of the electroscopes was a letter of the alphabet. Thus each letter had a separate electroscope and line wire, and when the line wire A was charged the electroscope devoted to A was diverged. To read off a message it was necessary to observe the order in which the pith-ball electroscopes were deflected, and by noting the corresponding letters the message was read off.

But it was not till 1816 that a telegraph employing a single wire was invented. Mr. Ronalds, now Sir Francis Ronalds, conceived the idea of using two clocks with dead beat escapements, one placed at the sending station and the other at the receiving end of the circuit. These clocks had rotary dials with letters of the alphabet engraved on them, in front of which was placed a screen with an aperture through which but one letter at a time could be seen. On both clocks being set going simultaneously the letters of the alphabet appeared in succession at both stations. At each end of the line wire and in front of the dials of these clocks were placed pith ball electroscopes, which were kept continuously distended by keeping the line wire charged by means of an electrical machine. When the letter which was to be transmitted appeared at the aperture of the sending clock, the line was discharged by connecting it to the earth, the pith balls immediately fell, and the observer at the receiving station noted the letter at the aperture when the pith balls fell. Thus the observer's attention was continuously fixed on the dial, and when the pith balls dropped the letter which happened to be in the aperture was the signal sent.

In 1819 Oersted made the discovery that an electric current on passing through a wire made it a magnet, and that it deflected any needle so long as a current passed.

In 1820 Ampere presented to the Royal Academy of Sciences at Paris a plan for an electric telegraph constructed with magnetic needles surrounded by coils of wire, and pointed out the great distance over which signals could be communicated.

In 1832 Baron Schilling constructed an electric telegraph which he exhibited before the Emperor Alexander, but died before his invention was perfected.

In 1836 Gauss and Weber constructed a telegraph, the first practically worked over a mile and a quarter. The currents were derived by a magneto-electro machine, and a commutator was employed to reverse the direction of currents flowing into the line. The receiving instrument consisted of a coil of wire 3000 feet long, and having a magnet placed within it. After the manner of Oersted's celebrated experiment, signals were conveyed by positive and negative deflections.

In 1837 Professor Morse, in America, contrived his electro-magnetic telegraph, in the same year that Cook and Wheatstone patented the five-needle telegraph which was shortly afterwards employed on the Great Western Railway. Underground wires were used for this.

In the same year Steinheil, at Munich, stretched wires over the houses from the Physical Cabinet of the Academy to the Observatory of Bagenhausen, a distance of three miles. He employed three modes of signalling—first, deflection of a needle; second, sounding two bells of different tones; and, third, a magnetic telegraph which recorded signals on a paper strip by + and — currents.

The electric telegraph up to this time was not much more than a scientific toy (if I may use the term), and an instrument of curiosity and interest in the laboratory of the *savan*. England is indebted to the great practical energy and foresight of Sir William Fothergill Cook, who overcame numerous difficulties and fairly established the electric telegraph as a commercial undertaking of the highest importance. Aided by Sir Charles Wheatstone, who had experimented with the transmission of currents through circuits of varying lengths, they modified their arrangements, and the single and double needle telegraph became a trustworthy and reliable instrument for receiving and sending signal codes.

To establish telegraph communication between distant places, wires carried through the air and supported on insulators are always employed where practicable; as insulated wires, whether coated with india-rubber or gutta-percha, are subject to rapid deterioration when exposed to the air or buried underground. The line wire should be of as small a resistance as possible. The chief difficulty encountered is that of insulating the wire.

The transmission of signals through overground wires is practically instantaneous. The experiments of Guillemin and Biernoff give 111,847 miles per second as the velocity of electricity. It is evident that were perfect insulation practicable a very high rate of signalling would be obtained, the only retardation being the time of magnetising the instrument. Twenty-five posts per mile is the average number of supports for line wires in this country; and when the line has to be conveyed through tunnels the wire is insulated with gutta-percha or india-rubber coating; but it is always most desirable to carry the wires over the top of the tunnel and across the country whenever it can be done, as the greater number of leakages occur from the deterioration of the insulated wire. They are also exposed to being damaged by red-hot cinders thrown out by the engines in passing, and many contacts and loss of insulation have arisen from that cause. Under the most favourable circumstances the insulation of lines is not perfect. There is a loss at every insulator. The attention of engineers has therefore been directed to the better form of insulators and the construction of instruments which possess small magnetic retardation.

Insulators of various forms had their votaries. It was found necessary to establish a series of continued tests to determine the value of the relative forms and materials of which the insulators were composed. The results of the tests unquestionably prove that stoneware was better as an insulating material than porcelain. A series of experiments conducted by my brother, Cromwell Fleetwood Varley, made for the Electric Telegraph Company, of which he was the engineer, led him to design an insulator which is now universally adopted throughout this country. He found by tests that the same form of insulators gave varying results; and on examination of the cause minute flaws, invisible to the eye, and insufficiency of firing not vitrifying the stoneware, made them porous, and they became subject to saturation by moisture and lost their insulating properties. He had all the insulators tested by placing them in a trough of acidulated water and nearly filling the insulator cup, so that any pores or cracks would allow a circuit to be completed. A very sensitive galvanometer was employed (a great number of battery cells); by this means imperfect firing and minute flaws were readily detected. All such were rejected—which averaged about 10 per cent. in the earlier manufacture. In consequence of these tests

great improvements have been made by the manufacturers of insulators.

The form of insulator mostly employed is a double earthenware cup, which is separately tested prior to being put together with the ordinary cements. This form possesses the advantage that should the outer cup be cracked by frost, or more frequently by mischievous boys hitting them with stones, the inner cup remains intact, and thus maintains the insulation of the line. There is also a peculiarity in the form of the insulator. The lip is rounded on the inner side, as it was found that in a driving rain the water pours down the sides and forms drops on the lip. As insulators were previously constructed the drop was blown by the wind, and bespattered the inner cup; but by giving the cup a rounded lip on the inner side the drop, instead of being blown into the insulator, rolls up the lip and travels round till it reaches the opposite side, where it is blown away. In this manner a greater protection from spray is given to the inner insulator.

The more external diameter is reduced the greater is the surface insulation, the limit being necessary thickness for strength. In some cases, to economise the first cost, these insulators are made of one piece of earthenware. This insulator is one extensively used by the Post Office. The strain of the wires is chiefly borne by the terminal insulators, which, as they are not so numerous, a form possessing great mechanical strength is employed. Perhaps the best of these is Sir Charles Bright's umbrella shackle. On this head nothing more need be said.

The systems of telegraphy employed in this country at the present time are the Cook and Wheatstone needle telegraph, which is used for railway signalling and all lines where the communication is somewhat limited, and where the messages are of not sufficient commercial importance to warrant the expenditure of erecting more elaborate systems. The Morse system, although more expensive, is most extensively used for commercial and important telegrams. The messages being permanently recorded, errors in reading are avoided, as the slip once printed can always be referred to, saving the necessity of the message being repeated.

The next system is Professor Hughes' type-printing telegraph, which requires but a single current to produce a letter, is about four times more rapid than the latter, and as the message recorded is in type instead of code, does not necessitate being transcribed. But it is, nevertheless, a very costly instrument, and requires considerable skill on the part of the manipulators.

Other alphabetical telegraphs, as they are easily managed and do not necessitate the learning of code signals, are very suitable for opening up communication between police and fire-engine stations, Government offices, and private communication from one business firm to another. Requiring a greater number of currents per letter, they are not suited for working on very long circuits, and are not so rapid as the other systems.

The single-needle instrument is so very generally understood that I think it is hardly worth while drawing further attention to it, whilst on the other hand scarcely any important improvements have been required since it was first designed by Messrs. Cook and Wheatstone. The Morse, on the other hand, has been the cause of many novel introductions into telegraphy, all of which date from about 1854; and it is very doubtful if anything approaching to the limits of applicability has been reached.

The Morse apparatus comprises a tapper or key for sending a current and an electro-magnet, the armature of which carries a style which imprints a mark on a band of paper which is made to travel by clockwork. So long as the currents flow round the electro-magnet the armature is attracted, and forces the style against the paper. The upper roller, which is used to draw the strip of paper, has a groove turned in it to receive the style, and an embossed line is produced, the length of which depends on the time the armature is attracted. On the current ceasing, by raising the key, the armature is pulled back by a spring and ceases to mark. The code is produced by long and short durations of contact. In this form the Morse machine can be worked over a distance of twenty miles of line; but as the embossing requires considerable power it was found impossible to get rapid signals without a secondary instrument, termed a relay, which is capable of being moved with a feeble current, and completes a circuit between a local battery and Morse magnet every time a current flows into the line. The relay can be made susceptible of very great sensitiveness; and thus, when lines are of considerable length, and the loss through leakage and resistance is great, very effective signals are obtained by means of relays.

There are two kinds of relays—those which attract an armature and close the circuit so long as a negative or positive current flows into the line; and those which close the circuit when a current of one polarity is flowing into the line, and fall back on an insulated stop when the current is reversed. This latter form is at present the most rapid. When these are used it is necessary to employ a reversing key, which puts a positive current on the line when the lever is depressed, and negative when the lever is raised. Too much attention cannot be given to this class of instrument, as upon reliable contacts being made depend the signals. The double current key on the table presents some features of novelty. In the first place, it is a double current which is constructed with the fewest number of parts, and therefore less number of connections, which are frequently the source of failures in these instruments; there is a peculiar novelty in the mode of making contacts which first present a fair surface and meet the contact screw with a fair knock action; then when the lever is still further depressed the contact screw rubs sideways along the block, so that the surface is always kept bright. On returning, the break of contact occurs at one spot, and the disruptive spark takes place where it is not employed for contact-making, or where the burning up of the contact-plate does not affect the efficiency of key.

To enter fully into the principles involved in the construction of relays would afford abundant material to occupy another evening. The rapid rate in which by the automatic system signals are recorded is a very good illustration of extension of the relay principle.

On the table is a regulator relay for controlling the strength of current, which flows either into the line, or for preventing the magnetism in the receiving instrument reaching beyond a controlled limit, by this means permanent magnetism may be almost dispensed with, and ordinary electro-magnetic relays be made more reliable and of greater sensitiveness. My brother, Theophilus Varley, after the paper is over, will explain with pleasure the nature of his invention to any one interested in the subject.

The desirability of obtaining an instrument that would work over greater distances than the Morse embossing lever, made many engineers turn their attention to obtaining marks by inking rollers and styles. The best form of ink-writing Morse machine is undoubtedly that invented by Messrs. Digney, and made by Messrs. Siemens Bros. When carefully adjusted they are capable of working over 100 miles with great facility, no relay or local battery being required.

The rapidity of signalling depends upon the delicacy of the instrument employed. One of the chief items in obtaining this point is reducing the amount of motion of the recording armature to a minimum. In the instrument now on the table this point is gained by the adoption of a cylinder of black-lead such as is used in ever-pointed pencils. To mark the paper it is only requisite to raise the paper strip the smallest amount to make it touch the pencil; the instrument can be adjusted so that the armature need not move more than the thickness of the paper employed. This, however, is not the case with the inking wheel of the Digney instrument; the armature has to make a greater amount of motion in order to remove the inking wheel sufficiently far to avoid the capillary attraction, causing a blotted or continuous line. Hence we claim for this invention a more extended application, especially with reference to automatic signalling.

The Morse embossing style was long adopted in this country owing to its exceeding cleanliness; and were it not that ink-writers worked direct over greater distances, it is doubtful if they would ever have been employed in this country.

Pencil-writers would have long superseded the ink-writer from their great cleanliness but for one great obstacle, the difficulty of keeping the pencil pointed and at one uniform distance from the strip. This point is accomplished in the following manner. A rotary pencil-case is placed at an angle of 45° to the strip of paper; the pencil moves freely down the tube of the rotary pencil-holder, and the marking point of the lead rests against the vertical stop. The vertical side of the cone cannot move beyond the face of the stop, and the horizontal side of cone is thus maintained at one distance from the paper strip. It is seen by diagram that if the pencil is broken it rests as shown in one figure. As the paper strip travels it sharpens the point, as seen in another figure, and ultimately makes a perfect cone, as in third figure. It is impossible in a paper of this description to describe the automatic system of signalling—an hour alone could be devoted to the subject. But I hope on some future occasion to read another paper on "Relays, and their application to Telegraphs," which will include automatic signal transmission, and the means of working over long telegraph circuits and submarine cables, in which the various forms in use can be more fully entered into.

ON EXPLOSIVE AGENTS APPLIED TO INDUSTRIAL PURPOSES.

By F. A. Abel, F.R.S.

Mr. Abel's paper recently read at the Institution of Civil Engineers commenced with a brief review of the nature and properties of gunpowder, and its special advantages and defects as an explosive agent for industrial purposes. The application of chlorate of potash to the production of mixtures more violent than gunpowder was discussed, their general susceptibility to explosion by friction or blows was pointed out, and some comparatively safe compounds of this class, such as Horsley's powder and a substance called tutonite, were specially noticed. The salts of an organic acid, called picric acid, now produced in large quantities by the action of nitric acid on the well-known antiseptic carbolic acid, were described as endowed with explosive properties, and as furnishing very powerful agents when mixed with chlorate of potash or saltpetre. Of these the "poudre picrate," or mixture of picrate of potash and chlorate of potash, was the most violent, but was far too dangerous, on account of the readiness with which it exploded by friction, to permit of its technical application. A mixture of picrate of ammonia and salpetre, designated by Mr. Abel as "picric powder," was described as certainly not more dangerous to manufacture and to use than gunpowder; considerable quantities had been produced with the ordinary appliances of gunpowder-works, and the material had received safe and successful employment as a violently explosive charge for shells.

Numerous other products of the action of nitric acid upon organic substances, endowed with explosive properties, were stated to exist, but only two of them—nitro-glycerine and gun-cotton—had hitherto received practical application, and these two constituted at the present time the chief rivals of gunpowder in many of

ts most important uses. Attempts were made o apply gun-cotton immediately after its discovery in 1846, and long before its properties vere understood; but nitro-glycerine, which vas discovered in 1847, had continued a chenical curiosity for sixteen years, its manufacure and application having been developed luring the last nine years.

The early history of gun-cotton was briefly eferred to, and it was shown that, even in he first days of its production and application, mportant results were arrived at, though the oo hasty attempts to utilise it led to its speedy bandonment, as a highly dangerous material, y all but the Austrians. The improvements ffected by Baron von Lenk in the application s well as in the manufacture of gun-cotton, vhich first became public in 1863, led to a reumption of the employment of this agent in England, and to its careful study by a special Government committee and others. The ad-'antages of the Austrian gun-cotton as a uining, quarrying, and engineering agent vere pointed out, as also the considerable mprovements in point of power, economy, afety, and convenience in use, in facility nd uniformity of production, which had been ffected by the reduction of gun-cotton fibre o a finely-divided condition, and its subseuent conversion into highly-compressed hoogeneous masses. The rigidity of the charges f gun-cotton, and their consequent occasional endency to become jammed in irregularly-haped blast-holes, were, however, shown to e occasional sources of accident; and the ecessity for strongly confining gun-cotton, n order to develope its full explosive force, vas a defect which existed until recently, and ad for a time rendered the material decidedly aferior to nitro-glycerine.

An account was next given of the successful anner in which Mr. Alfred Nobel had developed the practical application of nitro-glycerine. His discovery, that the explosion of this quid could be brought about through the gency of a detonation, and its successful ianufacture, combined to furnish the indusrial world with the most powerful explosive gent hitherto susceptible of application, and 'hich agent, from its high specific gravity nd insolubility in water, presented the special dvantage that it could be used in positions hence water could not be excluded. The isonous nature of the substance constituted n objectionable quality, and some uncertainty ccasionally attended its employment, but its rincipal defects arose from the fact of its eing a liquid, and from the comparatively igh temperature at which it froze. The ajority of the numerous fearful accidents hich had occurred during the transport and andling of nitro-glycerine appeared to be aused by the accidental leakage of the liquid om receptacles in which it was confined. he liability of such leakages to escape observation, and to lead to accidental explosions hich would be transmitted to the confined tro-glycerine, and the reckless manner in hich the frozen nitro-glycerine had been freuently dealt with, in consequence of its appantly inert condition, had been fruitful sources disaster, which had rendered the liquid, in s pure condition, a very unsafe material for nployment as a mining agent. But Mr. obel had succeeded in applying nitro-glycene in a simple manner, by which its defects, 'ising out of the liquid nature of the material, ere remedied. He mixed nitro-glycerine with porous and finely-divided silicious earth, and ms obtained a solid but plastic preparation, hich could be conveniently handled and conrted into charges of suitable dimensions, sceptible of application like any other solid cplosive agent, and capable of detonation uite as readily as the pure nitro-glycerine. his mixture, called dynamite, and of which ne or two varieties were prepared by Nobel, as stated to be one of the safest, most convenient, and most powerful blasting and mining gents. As now manufactured, in the form of mpressed charges, it retained as much as 75 r cent. of nitro-glycerine, without exhibiting y tendency to a separation of the liquid iring transport and storage.

Several other nitro-glycerine preparations of more recent production were referred to, all of which might be regarded as modifications of dynamite. In some of them, such as Horsley's mining powder, dauline, and glyoxiline, solid explosive compounds or mixtures were employed instead of porous silica as the absorbents of nitro-glycerine; in others, as in lithofracteur, the silicious earth and nitroglycerine contained in dynamite were in part replaced by semi-explosive substances—for example, by gunpowder constituents. None of these newer preparations contained so high a proportion of nitro-glycerine as dynamite, and although some of them, such as lithofracteur, might vie with it in regard to safety, it was scarcely possible that the substitution of other explosive substances for a proportion of nitroglycerine in the mixture, could result in the production of an equally powerful explosive agent.

When it was found, by recent experiments, that gun-cotton in the compressed form could be exploded by detonation like nitroglycerine and its preparations, that substance proved to be quite analogous to them in its behaviour, though the pure nitro-glycerine still remained somewhat the strongest explosive agent. The suddenness of the explosion developed by detonation permitted of the application of compressed gun-cotton and nitro-glycerine preparations to purposes of destruction without any confinement, and thus operations could be expeditiously and effectually carried out with comparatively small quantities of these materials which could only be accomplished by exorbitantly large charges of gunpowder. The rapid demolition of military works, bridges, &c., the breaking up of boulders, large masses of rock, guns, or castings or forgings, were quoted as operations of this class.

The author pointed out some of the causes of the great difficulty experienced in arriving at anything approaching a precise estimate of the relative power and effect of different explosive agents. Taking dynamite as the type of the practically useful nitro-glycerine preparations, and as certainly one of the strongest, experience had shown it and compressed guncotton to be about on an equality in point of power, and to exhibit, in their most advantageous applications, a strength which was estimated at six times that of powder. The plastic nature of dynamite, and its power of resisting penetration by moisture, gave it advantages over compressed gun-cotton, as it could be used in wet blast-holes, and as very irregular holes, or holes terminating in fissures, could be more conveniently and heavily charged with it than with gun-cotton. On the other hand, the readiness with which dynamite froze and its inertness unless thawed or fired by special arrangements, and the unpleasant effects experienced occasionally by those using it, were inconveniences not shared by guncotton. The advantages presented by these materials, in their general application as blasting agents, were shown to consist chiefly in saving of time and labour, especially in tunnelling or in blasting in hard rock. They were also susceptible of advantageous employment as auxiliaries to gunpowder in the rapid removal of large masses of rock or of submerged wrecks, the violent explosive agent being first used to produce extensive rending and shattering effects, and the superior displacing effect of powder being afterwards brought to bear. It was pointed out that gunpowder could not be satisfactorily replaced by these violent explosive agents in some kinds of work, where its comparatively gradual action was a specially valuable feature.

In conclusion, after referring to some recent interesting experiments of Dr. Sprengel on the application of readily oxidisable and other powerfully oxidising liquids in the production of violently detonating mixtures, the author showed that even in the application of gunpowder to industrial purposes some decided advance had lately been made, for its violent explosion could be developed, like that of all other explosive mixtures and compounds, through the agency of a detonation, whereby its action might be considerably intensified, and its application to some important classes of work, *e.g.*, in submarine operations, greatly facilitated.

Recent American Patents.

(From the Scientific American).

Harvester Rake.—William H. Hurlbut, of Miralile, Mo.—This invention relates to apparatus connected with reaping machines for the purpose of removing the cut grain from the platform of the machine, and consists in mechanism for operating the rake. The operating lever receives a vibrating motion from the reaper, produced in any of the well-known ways, which is imparted to a plate and shaft by means of a curved rod and pivoted bar. This motion is equal to about one-fourth of an entire revolution, and the rake is made to describe about one-fourth of an entire circle by means of projecting lugs on the plate. In addition to this circular sweeping motion of the rake, it is necessary that it should have a revolving motion, in order to raise and depress the teeth. This is produced by means of a horizontal arm which is rigidly attached to the shaft, a curved arm which is rigidly attached to the rake-head, and a connecting rod. As the shaft is vibrated the rake-head will be turned about one-fourth of an entire revolution. This raises the teeth of the rake to an upright position when they sweep back from the cutter-bar, and the revolving motion depresses them to a horizontal position when they return.

Canal Boat.—I. Joseph Hilgerd, of New York city.—This invention has for its object to improve the construction of canal boats, so as to enable them to be propelled through the water with greater velocity and without injury to the banks; it consists in the following construction:—Two wheels made in the form of frustrums or cones, placed apex to apex, are attached to the shaft to which the power is applied. They are made air and water tight, and have paddles or blades, slightly inclined or spiral, attached to their conical surfaces. The walls of the forward part of the boat at the side of the wheels are made double, and air and water tight, to serve as floats to buoy up the bow of the boat. The boat is made with two keels, one upon each side of its bottom. The keels are made air and water tight, to assist in floating the boat. They also form a channel or water-course along the centre of the boat's bottom to receive the water from the wheels to prevent the banks being washed by the swell. They also prevent the boat shaking. Two rudders are used one at the rear end of each keel. They are made triangular in form to prevent them stirring up the sand or mud in the bottom of the canal in shallow water, and are connected by a cross-bar, to the centre of which the tiller is pivoted. The tiller is pivoted to the tiller-post at the centre of the rear part of the boat. By this construction, the boat draws less water while carrying a heavier load than boats constructed in the ordinary manner, and at the same time the wheels cut down the water in front of the boat and force it inward and rearward through the channel in the bottom of the boat, so that it loses its force before being discharged at the stern, and thus prevents the formation of a swell which might injure the banks, and enables the boat to be propelled faster than ordinary boats can be.

Machine for Manufacturing Ice Cream.—Charles Gooch, of Cincinnati, Ohio.—This is an apparatus designed to be used in manufacturing ice cream in large quantities, and is adapted to the production of different flavours and qualities of the article in a more expeditious manner than heretofore. It consists of an arrangement of a horizontal driving shaft in such relation to a series of vertical

driving shafts and parallel horizontal ways, on which the cream receptacles are moved up to and away from the said vertical shafts, to allow their dasher-stems to be coupled therewith, so as to adapt the driving shaft to operate the dashers singly and successively or simultaneously.

WOOD SCREW.—Edwin S. Wills, of 917, Ridge Street, Philadelphia, Pa.—The first part of this invention relates to a spoon-shaped point to the screw for forming a boring and tapping device, so as to dispense with the necessity of boring the wood previous to the insertion of the screw. The second part relates to a central bore of the screw from the concavity of the point throughout its whole length for the passage of the borings. This screw will not split the wood, as the spoon point cuts through the fibres, and the central bore allows ample space for the chips. Machine screws made on this principle are found to operate well. In putting ordinary screws into hard wood, the friction attendant upon the thread crowding the fibres out of place is very great, and it is hard work to drive the screw. With the improved screw the fibres are cut through by the tapping point sufficiently to remove a portion of the friction and to secure easy driving, but not enough to prevent the screw retaining a tight hold on the wood.

SEED PLANTER.—David Lorriaux, of Ottawa, Ill.—This invention furnishes an improved seed planter, which is so constructed that the dropping device may be operated automatically by the advance of the machine, and so that it may be adjusted to work faster or slower by the driver while the machine is in motion. It consists of various parts, and cannot be described in detail for want of space.

Correspondence.

*** Discussion is invited upon any subject within the scope of the SCIENTIFIC REVIEW in which its readers may be interested, but correspondents are requested to be brief, as space is limited, and to remember that each individual writer is alone responsible for the opinions he may express.

EXPENSIVE PATENTS.

To the Editor of the SCIENTIFIC REVIEW.

SIR,—A great deal has been said of late in favour of the cheapening of patents. I cannot but think, even as a patentee, that much may be said on the other side; but I am open to conviction. The difficulty which an inventor who is not also a manufacturer has in bringing out his work is no doubt increased by this expense, and he is sometimes deterred by it, as any other man may be in carrying out a commercial opening or enterprise by want of capital. But probably it is rare, comparatively, that this is the case if the invention is really worth protection or deserving of it.

If patents were too cheap, would not the number of insignificant inventions rather check than encourage the more valuable? This, no doubt, may be partly obviated by an official scrutinising commission upon its worthiness in the first instance, but this would still give an equal chance of some really good thing being shelved, the inventor himself often being the better judge of the merits and prospects of a yet untried article.

The argument that the public is taxed by the artificial price put on to pay for the stamps cuts both ways; for at present the fact of its being patented is to some extent a guarantee for its genuineness, and, though its sale may be somewhat checked by this cost in the first instance, it will probably succeed in the end. Individual injury has sometimes resulted from the expensiveness of law; but upon the whole probably this expensiveness is the greatest possible deterrent to useless litigation, and thus expensive stamps are a deterrent to frivolous patents.

At the same time it must be acknowledged that international protection, without the need for such very large outlay as is involved by taking a fresh patent for every country, and even every colony, would give a great stimulus to valuable invention, and would be a mutual benefit to many countries.

That a patent law is generally considered advantageous to a community, and is the legitimate desert of invention, is proved almost indisputably by the universal consent and practice of the civilised world, whatever may be said to the contrary by some of our most eminent reforming lawyers and statesmen. But when community of property in an individual invention shall be considered necessary to the welfare of a state, it is pretty certain that community of landed property must soon follow if any principle of consistency continue to prevail.

I am, Sir, your obedient servant,

WILLIAM WHITE.

50A, Wimpole Street,
June 6, 1872.

SUBTERRANEAN WATER-SPRINGS.

To the Editor of the SCIENTIFIC REVIEW.

SIR,—Allow me by the present letter to direct the attention of your readers to a modern and yet imperfectly known science which is of considerable practical importance, and not devoid of interest to the reading public. I refer to the science whose object consists in studying the subterranean waters, the kinds of ground where they are to be found, their flowing, the physical laws that rule their abundance or scarcity, and their depth.

The circumstances which accompany the circulation of water on the surface of the earth have been thoroughly studied, but few persons have surmised what becomes of the rain-water absorbed by the soil, and still fewer have tried to account for it.

A Frenchman, however, named Paranelle, resting his researches on sound geological knowledge, devoted himself to the solution of this problem, and to the application of the principles he had discovered by long experience. The science is now complete, it has received a name—Subterranean Hydrology or Hydroscopy—and its applications are perfectly definite. Among these we must place in the first rank the discovery of springs and selection of well-sites. Let the reader think of the immense practical benefits which may be reaped from such a science. How many towns, villages, private estates are deprived of water, or obliged to get it from remote places at enormous expense. At this time so grave a deprivation is no longer irremediable.

Within easy access of every village, almost of every house, and generally at little depth below the surface of the soil, there exist subterranean streams of water. By a simple digging (indicated after a thorough survey of the place, and not by the aid of those clever divining rods that have made so many dupes) these hidden streams can be channelled out and made to flow on the surface, or else a well can be sunk on their course, and the place formerly deprived of water will become abundantly supplied with it.

Is there any science which deserves more to be studied? In opposition it may be said that these are the promises of theory, and that practice may considerably bring down such expectations. To this I will only reply that Paranelle has discovered over 9500 springs, that he has disciples who are not less successful than he was, and continue illustrating by facts the excellence of the method.

I might add long developments about the applications of the science referred to, but fear I should be intruding too much on your columns.

I conclude, therefore, trusting that you will judge the subject worthy of public attention, and on this account admit these few remarks.

I am, Sir, yours obediently,

LEON JOURD'HUI, Hydrologist.

Linden House, Twickenham, (Midd.)
May 28th, 1872.

THE MITRAILLEUSE ANTICIPATED.

To the Editor of the SCIENTIFIC REVIEW.

SIR,—I have seen it stated that in Luttrell's "Diary," under date January, 1690, mention is made of an expedition being fitted out against Ireland, and amongst the munitions taken are "four of the new invented wheel engines which discharge 150 musquet balls at once, and, turning the wheel, as many more; they are very serviceable to guard a passe." Have we in this case only an old friend with a new face, and is this the original of the mitrailleuse guns? Can you or any of your readers verify this statement?

ENQUIRER.

Chelsea, 17th June, 1872.

APPLICATIONS FOR LETTERS PATENT.

(*Continued from page 98.*)

books, and other like articles. 1516. J. Baird. Treating oils.—1517. F. Le Breton Bedwell. Boats' fittings applicable to the saving of life. 1518. W. C. Anderson. Method of securing sheets or panes of glass in horticultural and other structures.—1519. J. H. Lindblad. Construction of buffers for railway and other similar uses. 1520. D. A. Carr and C. P. Barlow. Electric distant signal apparatus for railways to signal to and from a train as it approaches a signal station.—1521. C. Hervieux. Tanning, and apparatus used therefor. 1522. D. Cunningham. Construction and working of caissons, which improvements are also applicable to movable bridges and the gates of docks and canal locks. 1523. J. L. Pichery. Improved safety lock.—1524. J. Risdale. Ships' side deck and other lights, port-holes, and scuttles.—1525. E. Solvay. Manufacture or production of carbonates and bicarbonate of soda and accessory products thereof, and also in apparatus used in such manufacture. (Complete Specification.)—1526. G. Dixon, T. Hughes, and J. Maddox. Cutting arrangements, applicable to looms for the production of ruches and other fabrics.—1527. R. Dixon. Pickers used in looms for weaving. 1528. R. Shaw. Drawing frames used in the preparation of cotton and other fibrous materials.—1529. J. Armytage. Apparatus for ventilating sewers and drains.—1530. S. Cook. Weft forks used in looms for weaving. 1531. S. Holman. Apparatus for raising and lowering heavy bodies.

On 20th May.—1532. W. Foulis. Exhauster and blower for gas and other aeriform bodies. 1533. J. R. Croskey. Treating asphalte or bitumen whilst being laid down for pavements and previously thereto, and of constructing pavements having an asphaltic or bituminous surface.—1534. J. Keene. Intuitive instruction in numeration (com.)—1535. J. Ingham and W. Shaw. Looms for plain weaving.—1536. W. Clark. Improved luncheon or refreshment case (com.)—1537. E. A. Calahaw. Electric signals or alarm apparatus. (Complete Specification.)

On 21st May.—1538. F. R. Gaspary. Threading machine for acting sewing machines.—1539. W. Weldon. Manufacture of soda, potash, hydrochloric acid, and chlorine. (Complete Specification.)—1540. H. Kenyon, H. Kenyon, and I. Swindells. Manufacture of chlorine and sulphuric acid.—1541. W. H. Dupré. Wind guards and other ventilators. (Complete Specification.)—1542. G. R. Wood. Steam boilers and furnaces.—1543. R. A. Browne. Utensil to be adapted to saucepans, fish kettles, and such like cooking utensils.—1544. J. Holmes. Coats and waistcoats.—1545. T. G. Messenger. Coupling of pipes, and in the fittings thereof, and in valves to use in connection therewith, and for other similar purposes.—1546. E. G. Brewer. Stocking or hose (com.)—1547. C. A. C. Eckhold. Apparatus for producing and applying motive

power.—1548. E. Poulson. Apparatus for securing the safety of sailing and other boats —1549. J. A. Mee. Machinery or apparatus for drawing wire.—1550. J. Worrall. Improved mode of and apparatus for dyeing cloth.—1551. J. L. Baker and T. N. Cox. Ploughs.—1552. H. A. Bonneville. Machinery for treating cotton seeds (com.)

On 22nd May.—1553. W. R. Lake. Rolling bearings for plummer-blocks, axle-boxes, and other journal supports (com.)—1554. G. Haycraft. Manufacture of pebble gunpowder, and in machinery for the same.—1555. W. Lockwood. Safety valves for steam boilers.—1556 J. Ricketts. Stationary and other cases constructed with two or more lids or covers.—1557 S. Cates and W. Swindlehurst. Printing upon metallic or other surfaces by transfer.—1558. M. A. Soul. Pumping apparatus for compressing atmospheric air or other gases (com.)—1559 T. Cocks. Machinery or apparatus for digging and gathering or collecting potatoes, turnips, and other agricultural roots —1560. T. Cocks. Machinery or apparatus for planting potatoes.—1561 F. Holloway. Presses for cutting and embossing various substances.—1562. J. Fielding and W. Duckworth. Brakes for railway trains.—1563 W. B. Woodbury. Magic lanterns (com.)—1564. T. B. De Forest. Machine for making pins (Complete Specification.)—1565 T. B. De Forest. Machine for sticking pins in paper (Complete Specification.)—1566. P. Michaelis. Apparatus for stoppering bottles (com.)—1567 P. Michaelis. Capsule for bottles (com.)—1568. M. M. Harris. Hubs or naves for the wheels of vehicles (com.)—1569. S. Sanderson. Fire indicating apparatus.—1570. R. Thomas. Tinting or colouring spectacle and other lenses.

On 23rd May.—1571 T. Brooks. Manufacture of steel.—1572. G. Westinghouse. Slide valves for steam and other engines.—1573 J. E. Rogers. Differential screw motion applicable to presses, punches, rail benders, shaft straighteners, and other mechanical contrivances of a similar character.—1574 W. R. Lake. Manufacturing [illegible] (com.)—1575 W. R. Lake. Apparatus for removing seeds from raisins and similar fruit (com.)—1576. W. R. Lake. Couplings for railway carriages (com.)—1577. A. J. Murray. Treatment of sewage deposits.—1578 R. Rowat. Elastic metallic webs, applicable for carrying material, or as window shutters or otherwise.—1579. J. Knowles and J. C. Mayell. Portable cooking apparatus for field or camp use and an improved formation of trench in connection therewith.—1580 W. Inge. Improved feed water heater for steam boilers.—1581 P. F. Connelly. Screw propellers.—1582 J. [illegible] Scissors, shears, and forceps.—1583 J. C. Johnson. Manufacture of Portland and other cements.—1584 W. R. Lake. Apparatus for propelling ships and other vessels (com.)—1585. W. R. Lake. Manufacture of blocks for paving and other like purposes, and an apparatus employed therefor (com.)

On 24th May.—1586. W. R. Lake. Processes and apparatus for the extraction of oil and the production of flour from maize (com.)—1587. L. V. Simon. Improved system of gun called the "elementary fictitious Chassepot," to be used in the colleges and lyceums. 1588. C. Muratori. Substitute for iron and steel, chiefly designed to be used in the construction of defensive armour for soldiers, and in the building, lining, and covering of ships.—1589. J. Imray. Manufacture of iron and steel, and apparatus therefor (com.)—1590 J. L. Boone and R. Herman. Construction of the permanent beds of railroads, which improvements also embrace an artificial railroad tie or sleeper of a semi-elastic or woody nature, and which block can be adapted to various similar uses. (Complete Specification.)

On 25th May.—1591. G. T. Bousfield. Combination tool for use in mending machinery belts, and for other purposes (com.)—1592. J. Farquharson. Breech-loading fire-arms.—1593. L. A. da Costa. Construction of traps, waste-plugs, or gullies, for baths, sinks, drains, and other conduits of water or other fluids.—1594. W. E. Newton. Caloric engines for obtaining motive power (com.)—1595. F. Le Breton Bedwell. Life-buoy.—1596. H. Figanter. Voltaic or galvanic batteries.—1597. A. B. Houghton. Apparatus for locking up or securing type or other printing surfaces in frames or "chases," and for locking chases on the beds of presses or machines.—1598. E. T. Hughes. Furnaces for puddling, melting, reheating, cementing, and for heating boilers (com.) (Complete Specification.)—1599. J. Shackleton and J. P. Binns. Machine or apparatus for "tieing-in" warps.

On 27th May.—1600. F. J. Chesebrough. Machinery and apparatus to be used in the process of manufacturing oil from seeds (com.)—1601 R. Jackson and J. B. Jackson. Machinery or apparatus for cutting files.—1602 S. Smith. Mode of opening and shutting doors of vehicles, and in apparatus therefor, which improvements are more particularly applicable to common road carriages.—1603. E. Mather. Splitting, separating, cleaning, and dressing filamentous materials, more especially rhea or china grass, and in machinery for these purposes.—1604. R. Irvine and J. Mackintosh. Manufacture of paper stock.—1605 C. E. Wallis. Repeating or revolving fire-arms.—1606. W. Easterbrook. Mechanical contrivances and apparatus employed for locking, and more especially for actuating or setting in motion the locking and interlocking gear for governing railway points and signals.—1607 F. Walton and J. Jones. Machine for manufacturing nuts for screw bolts.—1608 J. H. Selwyn. Treating refractory ores of silver.—1609 T. B. Harris. Moulds for the production of india-rubber valves and other articles.—1610 W. H. Davey. Machinery for ironing, calendering, or smoothing [illegible] and other fabrics.

On 28th May.—1611 A. C. Hobbs and J. M. Hart. Safes and other depositories for property and other articles of value, and in doors for such and other purposes, and in locks or fastenings for the same, part applicable to other structures.—1612. C. A. C. Eckhold. Apparatus for supplying ink on a pen fixed in a holder.—1613 H. B. Barlow. Machinery or apparatus for washing, dyeing, and otherwise treating fibrous substances and other materials (com.)—1614. A. M. Clark. Engraving, cutting, and carving machine (com.)—1615 S. Duer. Mode of and apparatus for lifting ships out of the water.—1616. J. H. Johnson. Treatment of copper precipitate and in the utilisation of impurities contained therein.—1617. J. Plump. Grate bars.

On 29th May.—1618 W. R. Lake. Manufacture of railway rails, and in apparatus employed therein (com.)—1619 W. R. Lake. Manufacture of railway carriage and locomotive wheels, and in apparatus employed therefor (com.)—1620 J. Rosslde. Means of concentrating light for signalling purposes, and in appliances connected therewith.—1621 P. A. [illegible] Tricycles and like carriages (com.)—1622. E. Burstow. Sash [illegible] fastener.—1623. D. Pidgeon and J. [illegible] Reaping machines.—1624 W. Hebell. Annealing pots.—1625 H. [illegible] Miners' safety lamps.—1626. A. Dawson and H. F. Dawson. Typographic etching and engraving, and in apparatus employed therein.—1627 J. Gatherole. Machinery for making bricks, tiles, and articles of various sizes and shapes of plastic, cohesive, and other materials, and for measures of capacity of various sizes and shapes.—1628 T. Slater. Apparatus for obtaining electric light, and in magneto-electric machines, to be used therewith, which machines are applicable for other purposes.—1629. H. L. Muller. Instruments for extracting or withdrawing nails, spikes, and bolts, and for other like uses (com.)—1630 T. Corbett. Winnowing and grain-dressing machines.

On 30th May.—1631. L. A. Guay. Buttons for cuffs, shirts, and other similar purposes.—1632. C. Martin and H. Martin. Anchors.—1633 T. B. Hawkes and C. J. Freeman. Tables to be used for billiards, dining, and other purposes.—1634 L. O. Lysons and H. V. Forbes. Manufacture or composition of paints or substances for covering or coating various surfaces.—1635. R. Long. Case or book for containing postage, receipt, and other stamps, and tickets and labels.—1636. E. Keirby. Machinery or apparatus for recording low water in steam boilers.—1637. C. Moseley. Condensing the vapours of coal-tar naphtha.—1638. H. Highton, M.A. Galvanic batteries.—1639. C. Whiting. Portable elongating dining and other tables.—1640. F. H. Wenham. Achromatic object glasses for microscopes.—1641. C. Boullier. Labels for stuffs and other similar purposes.—1642. R. Faulkner. Preparation of photographs and other prints for colouring.—1643. J. H. Dickson. Process of and machinery for treating fibre-yielding plants for the purpose of obtaining useful fibres therefrom.—1644. R. Hanson. Steam boilers.—1645. A. N. Porteous and G. C. Bruce. Applicable to lamps.—1646. W. R. Lake. Railway sleepers or cross-ties (com.)

On 31st May.—1647. J. F. Ollard and R. K. Barrow. Playing cards (com.)—1648. T. J. Smith. Producing and maintaining musical tones, and in apparatus for the purpose (com.)—1649. M. Doubell. Preparation of iron for purposes where great tensile strength is necessary (com.)—1650. T. Everitt. Feeding troughs or bins for sheep and other animals.—1651. J. Bolt. Stopper for bottles.—1652. E. T. Hughes. Safety valves for steam boilers (com.)—1653. N. S. Walker. Metallic bale tie or buckle.—1654 C. Turner. Machinery for scudding or paring skins or hides.—1655. W. R. Lake. Kilns for burning bricks (com.)—1656 W. R. Lake. Metallic packing for making steam, air, gas, or water tight joints (com.)—1657. D. Nicoll. Preparations applicable to woven and other fabrics for the purpose of rendering the same uninflammable.—1658. A. V. Newton. Manufacture of sugar, and in apparatus to be used therefor (com.)—1659. J. Cope and E. C. Barrett. Printing machinery.

On 1st June.—1660. C. Raymond. Sewing machines.—1661. M. Murfield and J. Ascott. Machinery or apparatus for preparing wool or other fibrous substances for combing or spinning.—1662. J. L. Norton. Manufacture of brushes, brooms, mats, and other pile fabrics.—1663. E. R. Hollands, W. Maker, and C. H. Jefferies. Meters for measuring water and other fluids.—1664. H. Clayton and H. Clayton. Machinery for cutting up clay and similar plastic materials into the form of bricks, tiles, or blocks.—1665. W. Darlow. Construction of portable magnets for curative and other purposes.—1666. W. R. Lake. Apparatus for preventing the escape of sparks, cinders, or other solid substances from chimneys or flues (com.)—1667 W. R. Lake. Boot and shoe heels (com.)

On 3rd June.—1668. W. B. Quelch. Methods of and apparatus for communicating between the several parts of railway trains.—1669. J. C. Tucker. Composition adapted to pavement and other purposes, and in apparatus for treating the same and also other analogous pavement and material. (Complete Specification.)—1670 T. Inwood. Dog-carts and other vehicles.—1671. J. Brown. Construction of gas meters.—1672. T. P. Hollick. Arrangement and construction of marine engines and boilers for driving twin screws of boats, yachts, and other vessels.—1673. S. T. Wentworth. Burners for consuming gas and air combined.—1674. J. Bchcrd. Looms for weaving.—1675. J. Robertson. Motion to liquids, in transmitting motion therefrom, and in apparatus employed therein.—1676 W. R. Lake. Steam-pressure regulators, and in the method of applying them to the drying cylinders of paper machines, slashers, and other like apparatus (com.)—1677. W. R. Lake. Treadle mechanism and castor apparatus for sewing and other similar machines (com.)—1678. A. M. Clark. Eyelets for boots, stays, and other articles, together with a tool for fixing the same (com.)—1679. C. W. Harrison and A. H. Harrison. Manufacture of gas for lighting and heating purposes, and in the apparatus employed therein.

On 4th June.—1680. W. Stother and G. Milton. Folding desks, suitable to be employed in schools.—1681 A. McKenzie. Restoring heat to steam boiler or other furnaces.—1682. A. Dugdale, J. Mingrat, and A. Vansteenkiste. Steam cocks, water cocks, and gas cocks.—1683. T. Hack. Pipe connections.—1684. G. Thomas. Portable cooking apparatus.—1685. G. Shaw and T. Shaw. Rotatory brushes and burnishers.—1686. J. Atkins. Metallic bedsteads and cots.—1687 R. Carey. Rotary pumps, applicable also as fluid meters.—1688. J. Bayman. Brushes, and in apparatus connected therewith.—1689. J. Sullivan. Hydrostatic safety apparatus for the rollers on rolling mills or other machinery. (Complete Specification.)—1690 W. Riddell. Manufacture of paper pulp from vegetable fibres and in apparatus therefor, which apparatus is also designed to be employed in making chloride of lime for bleaching pulp and in other similar

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The Scientific Review.

AUGUST 1, 18[illegible].

SCIENCE THE TRUE OBJECT OF EDUCATION.

Homer and Virgil, Horace and Xenophon, are doubtless poets or writers of antiquity not surpassed by any of modern days; but for all that those persons who are deeply imbued with their lore are in possession of a kind of knowledge that is useful enough in its way, yet is far inferior in real advantage, as regards the progress of modern civilised life, to even a moderate acquaintanceship with the Physical and Natural Sciences.

If elegance and intellectual polish be deemed the true end and aim of education, then classical knowledge must be the *Alpha* and *Omega* of teaching; but let it be conceded that to ornament and polish appropriately there must first be something sufficiently permanent and stable to justify the use of the artistic taste and labour involved in so doing, then it will follow that knowledge which enables us to ensure permanency and stability when required, is a kind of knowledge worthy of as high a status and of as much encouragement as that which refers to the maintenance and increase of elegance and beauty in our language and our arts.

If, however, these views be founded on truth and common-sense, they have hitherto had very little operative effect on society, more especially in our own day and our own land.

Education in the United Kingdom has been hitherto understood as embracing, first, elementary education, which commonly means the attainment of the knowledge of the "three R's," as they are termed—reading, writing, and arithmetic, with, perhaps, some acquaintance with grammar—a kind of knowledge when of a full and complete character which is of the highest importance, as it is the key to all other learning. Education also embraces that which is termed secondary, under which name is comprised the acquisition of more or less of classical lore—Greek, Latin, and so forth—together with some abstruse abstract mathematical problems got off by heart, and further advance in history and geography, with possibly a smattering of abstract knowledge of the natural and physical sciences. Lastly, our educational system embraces what may be termed tertiary education, which is obtained at our universities, and consists in further advances in the same curriculum as that of secondary education.

Here, then, we have a system of education well fitted to produce literary men and gentlemen, but singularly ill adapted to send forth into the world men capable of advancing industrial progress and real civilisation; for little have those who have been taught in the way described of that science which has any direct bearing on the utilities of every-day existence, for even should they have become proficients in mathematics it will be of that abstract kind which will [illegible] little or no [illegible] to its practical application. In fact [illegible] [illegible] will have engendered a speculative rather than a [illegible] [illegible] faculties.

[illegible]

time and money on that which must prove an utter failure in the end.

The education of the future must hold paramount the claims of science, and as regards general popular education must look to science in its applicative phase rather than in its pure or abstract form. Not, however, that the classical and literary curriculum should be abolished, for it ought to be still maintained for the behoof of those whose bent of mind is in that direction. In point of fact, thorough elementary education of the same kind should be available to and indeed enforced upon all, but as regards secondary education, that should be alternative; in some cases, being merely an improvement on the old and well established system now in use; but in other cases, and those the more numerous, being more of the technological type. And to render this thoroughly useful it must be attended as nearly *pari passu* with the same social and legal status for professors, teachers, and students as the ancient educational system boasts of; that is, if we have universities and grammar-schools for the latter system, we must have secondary schools and institutions for technological instruction, together with technological universities for the completion of this popular scheme of education.

Further, if we retain Doctors of Divinity and Laws, and Masters and Bachelors of Arts, we must also have our Doctors, Professors or Masters, Licentiates, and even Sub-Licentiates of Technological Science. The mere grant of certificates of proficiency and competency will not be sufficient, because one of the grand things for advancing this kind of education will be to dignify the status of those who are well versed in the sort of knowledge which we are beginning to understand is of so much national importance.

By this we do not mean that the school is to be turned into a workshop, but we wish to see the school co-operate with the workshop, what we really have to do being to advance technological education rather than mere technical instruction. We must, however, take care to be practical and not theoretical. Hence one of the prime requisites will be that in the forthcoming system of technological instruction those who teach applied science shall, as far as possible, have been practical workshop-men, for we can rely on no others to deal efficiently with the matter. A man must know the wants and be able to use the language of the artisan in order to instruct him as to what kind of scientific knowledge is necessary or useful to him in the craft that he practises.

We trust that the movement on this subject which we refer to in another column may do something to advance this good cause, to which we have already devoted so many pages of the Scientific Review. One of our Princes and one of the highest dignitaries of the land have come forward to place the matter before the public, and we trust that it will be well worked out, and not allowed to end in talk or vain attempts to work out a merely fanciful scheme, avoiding calling for the co-operation of the practical men without whose aid nothing can be done which will meet the necessities of the case. When we see the names of Mr. [illegible], Mr. Hodgson Pratt, Mr. Campin, Mr. [illegible], [illegible], and others who have already done so much to forward this cause, as taking a [illegible] [illegible] [illegible] shall feel more confident [illegible]

Reviews.

Air and Rain; the Beginnings of a Chemical Climatology. By ROBERT ANGUS SMITH, Ph.D., F.R.S., F.C.S., (General) Inspector of Alkali Works for the Government. London: Longmans, Green, and Co. 1872.

THE main object of this work is to develope the practical application of chemical science, to test and prove the character of the air in streets, towns, mines, and other places in which human beings have to permanently or temporarily live, in order that the deficiency of the vitalising element in the atmosphere may be made manifest in a specific and definite manner.

Possibly the best way to convey a true notion of the contents of this very valuable work will be to let Dr Angus Smith speak for himself in regard to the purport of the inquiries which occupy the principal part of his work. This he does in the following words.

"The history of our knowledge of air would make of itself a volume, and it might be a very interesting one, and almost amusing. It must stand by itself. It will be enough here if I give conclusions arrived at by my own experiments as a rule, making occasionally very slight deviations in order to bring in the opinions of others when they seem necessary for the elucidation of the subject.

Circumstances led me to approach the subject chiefly from a chemical point of view, with the occasional use of the microscope, because the condition of our knowledge at the time when I began the study pointed distinctly to the use of chemical experiment, and the microscope as the means of advance.

When the great discovery was made that oxygen was a part of the air, and was that which was required for breathing, men imagined the secret of health to be at length attained. Wholesome air was held as that which contained much oxygen or vital air. Many experiments destroyed this hope of happiness to men, he found that no air in nature did contain more than 21 per cent of oxygen, or at most only a slight trace above this, and that none contained much less, and that if it did contain more its virtue was limited, since even oxygen itself was no panacea. Infection might exist even where there was the full amount of oxygen, and it might be absent where a quantity was below the average, this state of things occurring in many situations when artificial conditions interfered, such as want of ventilation, and also in natural conditions where gases are formed which require to be removed by currents. As an example of this, we have the gases from the dying vegetation, and the endless amount formed over much of the earth and in the sea itself by the destruction of life and the incessant activity necessary on water and land to remove the refuse, and to make the way smooth for the living.

Many persons have examined the air, and it will be seen that many results have been attained, but latterly these have been very much alike, and it may be supposed that the question might be allowed to rest. The rougher work was done and done well, but Regnault began to refine it. He first showed the fine distinctions in the amount of oxygen in pure and tainted air. My work has been, so far as the gases are concerned, to carry this out further and to give minute details. These show that the mountains and great plains have an atmosphere different from that of cities, everybody knew this, but they have shown also the amount of difference. It is true that in figures this appears small, but what is the meaning of small? If we measure size by percentage, it will appear small, but still smaller will appear the strychnine that destroys us if we estimate the amount as a percentage of the weight of our bodies."

A tabular statement is given which shows the diminution of oxygen in places where the air is breathed, and it proves also that the analysis of air by estimating the oxygen is an important addition to a knowledge of its purity. The exaggerated amounts of oxygen at one time imagined are not found, but the necessity of attending to small differences is abundantly proved.

Carbonic acid exists in very small quantities in the atmosphere, but it increases around animals, and according to circumstances increases or diminishes around plants.

Having treated of the oxygen in various places, the amount of carbonic acid in the atmosphere of Switzerland and Spain is duly considered, after which the air of Manchester and London are analysed, in order to ascertain the presence of that constituent.

As to Manchester, Dr. Angus Smith makes the following remark:—

"There may be noticed in Manchester a tendency towards increase of carbonic acid as the day advances, as if at times the ventilation could not keep down the increase of acid: this is contrary to the results in a country place. There is less after rain, and less during high winds."

In regard to London the following quotation will interest many Londoners:—

"Pettenkofer informs us that the air of Munich may be taken as containing about ·05 per cent. of carbonic acid; with us it is certainly below this amount; and if it raised to ·05 by breathing, one would perceive it. May we conclude that such a small amount is imperceptible without organic emanations? Munich is very high; the air must sweep over the whole continent to come to it; it may wash up the carbonic acid, and, perhaps, oxidise the organic matter.

Air with a very small loss of oxygen is perceptibly deteriorated if its place is occupied with carbonic acid and exhalations from the person, although we are not able to say how far this is the case when carbonic acid alone is substituted for this small amount of oxygen.

On the Thames it is clearly seen that the open river is purer than the streets when the water is not putrid. It is purer above, at Westminster, than at London Bridge. London is freer from this gas than Manchester, although not equal to the parks in March and April, when the experiments were made. When the new sewers are complete the difference will probably be perceptible.

These analyses indicate that a very minute amount of carbonic acid shows deterioration of air sufficient for the senses to observe. The senses observe a difference between Manchester and the outskirts. The difference is ·0031 per cent. The senses observe it in London, where the difference between the streets and parks is ·0040 per cent. They observe it also on the Thames, and in wet weather. But they do not observe it in Munich, which has more carbonic acid than even these towns, and more than the New Cut or Lower Thames Street. The conclusion is that carbonic acid in these small amounts is not that which annoys us. In some towns it is no doubt sulphurous acid, in others organic matter and gases from putrefaction.

It does not follow that we must therefore neglect carbonic acid; on the contrary, it ought to be examined minutely, so that not the smallest increase be allowed, if possible; not that we know certainly of any positive evil which it can do of itself in these small quantities, but because it almost always comes in bad company.

In the analyses given the air containing ·0774 is really worse than that containing ·1604 and even ·3, because over the middens there is a little sulphuretted hydrogen. It is well, then, in such cases to use a double test. Indeed it is probable enough that other gases besides sulphuretted hydrogen, such as marsh gas and hydrogen, products of decomposition, are issuing from cesspools and middens. I should not say probable; it is really certain. These gases, [illegible] the carbonic acid, show the reason why less oxygen should be found in such places.

I believe these analyses are of importance in the inquiry into the state of the air of all places, as they teach us the meaning of a deviation from the normal amount of carbonic acid as well as of oxygen in the air. A deviation of ·02 is not pleasant to us when it is caused by simple want of ventilation. If it is accompanied with gases of putrefaction, it is much more hurtful, as some of these are very deadly.

These analyses teach us to be very careful not to allow the air to become deteriorated even to a very minute extent, and that a figure in the third decimal place is not to be despised; but they teach us more—namely, that in some places, such as high mountains, a slight increase of carbonic acid, such as is found in the third, or even to the length of 2 in the second place, is rather a proof that the oxygen of the air has done its work well and purified the atmosphere, and that this increase is probably owing to pure carbonic acid. It would be well to have the experiments of Schlagintweit confirmed, where ·07 and ·09 are found on high mountains. We all avoid an atmosphere containing ·1 of carbonic acid in crowded rooms; and the experience of civilised men is that it is not only odious but unwholesome. When people speak of good ventilation in dwelling-houses, they mean, without knowing it, air with less than ·07 of carbonic acid. We must not conclude that, because the quantity of carbonic acid is small, the effect is small; the conclusion is rather that minute changes in the amount of this acid are indications of occurrences of the highest importance."

Further inquiry was made in 1869.

The bad air in the Law Courts of the metropolis have often formed a theme for the animadversions of our judges and forensic practitioners. Dr. Smith testifies that these are well worthy of attention by stating that he went into one of them, and found it was extremely warm and unpleasant at the moment of entering, and even after some minutes it was not to be voluntarily borne. I therefore (he says) did not attempt to penetrate the mass of people, but took specimens of air when perhaps eight feet from the door. On coming out, the feeling of relief was remarkably pleasant. This feeling, as elsewhere explained, is usually accompanied with a restoration of the normal action of the heart and a calmer respiration.

The amount of oxgen in places not mountainous is given by me as 20·978—an average from many analyses. London always stands well in examinations of air, and the parks will contain about 20·9800, and sometimes more, judging from the carbonic acid of which estimations have been made, leaving out the oxygen. We have then 209,800 of oxygen in a million, but in the Law Courts only 206,500, or a loss of 3300 in a million. Examining the tables to which I have already alluded, we find no place above ground with such a small amount of oxygen, except the gallery of an extremely crowded theatre at half-past ten at night, when the whole evening has been spent in spoiling the atmosphere, and those places at the backs of our houses which we are not expected to name, much less to inhabit. Although by analysis these places were as bad as the court, in reality they were less so, as the court temperature was very high, and the organic matter from perspiration in proportion. The deleterious effects of this we are not yet able to judge of; the other we can to some extent measure. I say deliberately that this court where I took the air was worse than the middens alluded to.

The warmer air rises, and that at the ceiling is generally the worst. This, however, depends upon circumstances; if it has time to cool, from the height and space being great, the carbonic acid may be arrested before reaching a great height.

If from a space filled with warm air in which many persons have breathed, we fill

a flask and weigh it, we shall find that, unless the carbonic acid is unusually great, the weight is less than the weight of the same bulk of air taken before it was warmed by human beings. If we shut up the space and allow it to cool to its first temperature, and weigh a similar bulk of air, we find that it is really heavier than it was at first. Fortunately the warmth raises the air above us, and it seeks an exit away from our lungs, so that air rendered in this way impure is made lighter, but as soon as it cools, it is heavier than at first and falls down. To ventilate well, the air must be removed before it cools, and the heating, cooling, and ventilating must work in harmony. It is not easy to bring these agents to act so.

The air raised into the lantern above the court was inferior to that below, and contained only 20·4800 of oxygen, being a loss of 5000 in a million. Nature never seems to offer us air with a loss of even 1000 in a million. Comparing healthy places with healthy, the difference is about 200, and perhaps this indicates a similar difference of vital principle in the air.

I need scarcely say that I found no such loss of oxygen in the mills of Manchester, or in any other inhabited place above ground during the day. If we seek air similarly degraded, we must descend the shafts of mines, and there we find oxygen removed in some places to a much greater extent. As an average, however, the currents in a metalliferous mine gallery contain 20·6500 of oxygen, exactly the amount in the court, and the air under the shafts 20·424, almost exactly the amount in the lantern. I certainly am anxious to see legislation in favour of miners; but this is a circumstance rather adverse to my hopes.

From the air of London the work carries us to the air of the mines. The explanation of the method of analysis Dr. Angus Smith adopted he thus describes:—

To obtain specimens for analysis tubes of about ¾ of an inch (nearly 2 centimètres) in diameter were used, the length being 6 inches. They are drawn out at each end, and a fine tube 1¼ inch in length is left attached. Near the junction of the fine and the wide tube is a very narrow neck. They are, in fact, made after Professor Bunsen's model. The air is drawn through the tube until it is filled; and by the use of a candle and blowpipe the neck is melted and the specimen of air hermetically sealed up, so that it may be preserved for ages unaltered, as far as we know. The candles in many instances burned very badly and gave little heat, so that the act of sealing was difficult, and sometimes a failure. For this reason it will be seen that there are many numbers which have not the analyses attached, as it was found that the tubes leaked. In these cases the air may have been equal to that mentioned by Mr. Moyle, so that the worst would be left out. It may even happen that this is the reason for some specimens receiving a better character than they deserve, as the leak may not have been discovered. Most of the specimens were kept a few weeks before examination, some a few months; and minute leaks would be effective in that time in rendering the inside air equal to that outside, although that small leak might not be discovered during the short continuance of an experiment. At first the tubes were examined simply with the eye or a lens to see that the points were melted; afterwards they were dipped into mercury; if any leak existed, it was betrayed by the existence of a drop or more of the mercury entering the tube. If the tube is well handled in sealing, the lens is the best test. The tube was broken at one end under the mercury, and the air transferred to an absorption tube. In this graduated tube the amount of carbonic acid was taken, by absorption with moist balls of caustic potash. When the balls were moist it did not require quite an hour to complete the absorption in wide tubes; an hour and a half, however, was always the time given, whilst one set of tubes stood all night. There is no difference found between those which were done in the middle of the day and those which were begun on leaving the laboratory and kept to stand a night. As the number of analyses was very great, it became important to ascertain the readiest mode of going rapidly over them with accuracy. I had never been called on to prepare an amount of analyses at all approaching to the number now before me, and was a little alarmed. I began with the method of my master, Liebig, and obtained, in many cases, good results; but I confess to being very much annoyed with the endless washings required in order to remove the caustic solution of pyrogallic acid, a strongly-coloured liquid, from the tubes and from the mercury. Besides these troubles there was observed occasionally an unaccountable obstinacy in the solution, as it appeared extremely unwilling to rise, and wearied the hand by constant shaking and watching; nor was there any distinct mark to show the limit of the absorption or end of the experiments, except the exhaustion of the patience. I had, therefore, for some time given up the plan as a rule. Dr. Calvert objects to the method on account of an error of ·4 per cent caused by the formation of carbonic oxide. I may say, however, that I have sometimes and frequently obtained results far more accurate than the formation of ·4 per cent of carbonic oxide (see Dr. Calvert's paper, "Proceedings of the Lit. and Phil. Soc. of Manchester") would indicate, so that the amount formed cannot always be so great. However, I need not mention these results of mine, as Liebig himself and Bunsen, I believe, have both performed with pyrogallic acid very accurate analyses of air.

The method of explosion was preferred, and Bunsen's eudiometer used. Frankland's apparatus might have been taken if anyone could have been found to mend it in time. It would be interesting to know by which method the greatest number of analyses could be produced. With Frankland's apparatus one gas only is analysed at a time, but it is done very rapidly. Five or six eudiometers were used at once. For obtaining a spark various methods had been frequently tried. At one time for a while I was satisfied with the rosin electrophorus, but from the moisture of the climate it frequently became extremely difficult to carry to another room as much electricity as would cause an explosion, and no spark could be had except before a fire. Bunsen's tube was greedily sought, as a very simple method, and in dry weather acted well, but became at times quite useless, so that whole days were spent in obtaining a spark. A small electric apparatus was got, and then a large one was used, but both required peculiarly warm rooms, and sometimes in wet weather the mere opening of a door would render useless the machine for a considerable time, although one had a plate of about 18 inches diameter. It was then clear to me that to work with any comfort a battery and a Ruhmkorff's coil were necessary. With this apparatus the amount of work was multiplied by five at least, and made into a pleasure instead of a pain. The battery used was made of cast iron and zinc. It was, perhaps, unnecessarily large, there were 12 plates of cast iron, and 21 of amalgamated zinc of 6 inches square. This battery has been some years in my possession; the plates have never been renewed, and they are as smooth as at the beginning, although now becoming thin. It is lifted up and down into the cells by a pulley, so that the plates are only a few seconds at a time in the acid when a gas is to be exploded. After doing the usual experiments of a laboratory for a few years, it was set down to the induction coil about three years ago, and in that period, without special cleaning, and merely by a change of acid, once in six months, it has exploded perhaps from two to three thousand gas mixtures, besides being used occasionally for decomposing water. It makes us independent of weather.

My assistant at the time, being little accustomed to the use of this apparatus, preferred pyrogallic acid, and I was willing that he should take his experience, which ended in results similar to my own; at the same time I am bound to confess that quietness and patience produced better results. Still that quiet and that patience could not be found with 500 analyses waiting before us. It was, in fact, necessary to work on a scale and by a method where the feelings could be completely excluded, and the mechanism of the operation be responsible for the exactness. This point, I believe, was attained, with gain in time, in comfort, and in accuracy; when I say in accuracy, I do not mean that there is an actual increase of accuracy, but in the number of experiments which were not failures. The analyses spoilt by the explosion method are very few, and were in reality at the latter part of the inquiry reduced to almost nothing.

From mines the work proceeds to close places, and for better investigation experiments with a leaden chamber, in which the author remained some time, are given, and as these are of a very interesting character we cannot refrain from quoting from this part of the book:—

The first trial of the chamber was made by simply sitting down for an hour and forty minutes. This produces about one per cent of carbonic acid. The day was clear and the air pleasant, and the temperature [illegible] F. No difference was, to a certainty, perceptible for twenty-five minutes. Then when the air was drawn from the top by means of an umbrella, it seemed like a soft wind, and had to some extent a pleasing feeling, but was entirely devoid of a faculty of cheering.

A dull, cheerless air is well known. Here we had it produced at once. The air was very moist, and deposited water when drawn out through a tube on taking a specimen.

After an hour the unpleasant smell of organic matter, such as is so well known in a crowded school, was perceptible on stepping rapidly from one end to the other, or on moving the air rapidly. Here we learn that when a current of air blows on us the chemical actions accumulate, and although if continued for one instant only they may be imperceptible, if repeated for many they culminate in a sensation. A sensation, such as smell or taste, is evidently the result of a chemical action. This may be infinitesimally small; in that case the mind does not take cognisance of it; but if many of these small actions occur, either all at once, or so rapidly one after another that they cannot be separated, the mind observes them, and a sensation is the result. How many atoms or molecules must be moved to cause a sensation is not possible for us to tell, but we can very readily tell that for some persons one, two, or twenty times more must be moved than for others. These chemical actions are constantly going on in the body. They may take ten years to gather impetus to make their movements strong enough to produce sensations, and disease may be generally unknown to the individual, although it may kill him in the eleventh year. But if all chemical action began at the first so violently as to produce decided sensations, he would be able to avoid it at once before [illegible] any abiding impression. [illegible] bad climate is more dangerous [illegible] of vitriol, which we are [illegible] to move out of the way. [illegible] reason from very distant [illegible], as no smell is perceived [illegible] plains its character at once [illegible] tions.

Exactly in the same category as the bad climate are all places in which the air is inferior, without containing any peculiarity which the senses can detect. Now, although the mine air is all or nearly all such that the senses could perceive it at once, if we were introduced into it at once, we enter so gradually that we are scarcely conscious of the increasing deterioration. As it takes a long

time to enter, and a long time to come out, we are incapable of comparing the air of mines by the use of our senses in the same way that we can compare the air of any place above ground out of which we can come suddenly. This being the case, we are obliged to pay more attention to those phenomena that are only perceptible to the senses in their results after years, and also to chemical experiment, which two methods after all must turn out our most certain guides.

It was very decidedly perceived, after remaining an hour, that the air was soft when made to move in this chamber. This arose from the moisture, and shows us at least that a soft air may be a very impure one. Soft air—air with a good deal of vapour—is very soothing; it calms the mind and the body and the burning of a candle or a fire. In this state it cannot be very cold, as the warmth is essential to the existence of the vapour. This air has a tendency to leave the skin and its action unchanged; it causes little evaporation, and perhaps an influence is due to this, that the amount of oxygen introduced into the lungs is diminished, whilst no injurious ingredient is added. I think I hear the question, Will not the air in the lungs decide for itself at once how much vapour there shall be, as there is such an abundant moist surface? The entrance to the lungs, that is, the nostrils and the mouth, feel the moisture with great clearness, and when the air is dry they are dried up. But the lungs seem to feel it also, and it seems a very common thing to know the difference in the respiration. Dry air stimulates the skin, because it removes moisture, and the skin must set to work to renew it. Dry air, therefore, would in this respect be in its first action cheering, and in its last irritating. Moist air would from this point of view be calming in its action, and often at once calming to languor, probably preservative of the vital powers which are not frittered away by constant irritations. I speak only as a chemist.

After staying in the chamber for 100 minutes, the air had an unpleasant flavour or smell, and I came out; three persons entered at once and pronounced it very bad, I entered after a minute and found it extremely bad. It seemed to me, however, that we are frequently exposed to air equally bad, although I have not found any in daily life so much deprived of its oxygen as this must have been, reduced, that is, to twenty per cent.

I was extremely glad of the escape from this impure air; this gladness not arising from any previous discomfort. I was not uncomfortable. I chose that time of coming out, as it was the moment when the organic matter was most distinctly perceptible; still to perceive it when quiet required attention. The pleasure on coming out was one wholly unexpected, although I now recognise it as exactly that which one has when walking home on a fine evening after leaving a room which has been crowded—it was the reassertion of the rights of oxidation; the blood was evidently in active change desirous to take up a position that was lost, else why was this feeling of unusual delight in the mere act of breathing, which feeling continued for four hours? Dinner seems to have first removed it. From the long time required to bring the functions of breathing to their former state, we may of course argue that they had been much disturbed. If to this it is replied, that after all it was merely the memory of the chamber still remaining, it may be said that if the mind is fixed upon the subject, such a memory may exist, without, as far as we know, any equal corresponding prior affection of the body; but if the condition be unexpected and unthought of, the result seems to indicate distinct chemical or physiological action. In about four hours the lungs recovered their tone. By the tone is meant their unconscious working. Food seemed to be more than usually required, and was followed with unusual rapidity by the feeling of refreshment. Now as there was no unusual bodily exertion, the demand could not arise from an unusual wear of the system, and indeed the peculiar feeling was rather a need of support than actual hunger demanding food. We cannot suppose that much wear and tear was going on. We seem left to suppose only that the decompositions which are needful to repair the body had not been made, although material was present, and that it took four hours and dinner to make up lost time. Although oxygen does not directly repair, it takes the initiative in any union of labour for the purpose.

The second stay in the chamber, the day after the above, was continued for 160 minutes. At two hours and twenty minutes it was observed that very long inspirations became frequent and more agreeable than usual. The air about that time gave a very decided feeling of closeness. Standing on a chair it was found less agreeable than below. The amount of oxygen was found to be 19·81.

Immediately on opening the door two or three persons entered, and again perceived how uncomfortable it was.

Rain, the consideration of the nature, character, and effects of which forms part of the present work, is not a whit less interesting than air. As to this, Dr. Smith says:—

If there is life and death in the air, we must believe the same of the rain, which collects solids and liquids, not omitting gases and vapours. These contents show themselves to chemical analysis and the microscope, so that the distinctions between the air of different places may be known without the dangerous test on health. As this volume is a collection of early work in great part, it will be consistent to begin with my ideas when first finding practically how complicated the substance we call rain really is. It does not appear that I considered them new in principle, although new in some of their relations.

As I said before I have nothing which I can call actually new to bring forward here, but it does still present some novel feature. The air was not examined as such, because I had not proper convenience for the experiments, and I was compelled, therefore, merely to examine the rain. All the rain was found to contain sulphuric acid in proportion as it approached the town, and with the increase of acid the increase also of organic matter.

The existence of albuminous compounds may be traced in the rain, however carefully collected, and the still further vestiges of living creatures, minute animalcules, may be found also. These creatures are sufficient of themselves to show the existence of phosphates, whilst sulphates and lime may be readily obtained. In examining the Thames water, I often found that the readiest way of collecting the phosphates and magnesia was to wait for the animalcules to do it. When the residue of the rain is burnt, an abundant evolution of ammonia may be obtained; but I have not ascertained the amount, because it varies much, and I do not well feel able to collect all the ammoniacal salts which may have existed in the rain, as so much loss is caused by evaporation, even if an acid is present. All results hitherto obtained must have been approximative and too low.

This organic matter, however, is capable of decomposing and of forming ammonia when it falls upon the ground, and of furnishing food to all kinds of plants. There is enough, therefore, to grow plants scantily, although experience shows that there is not enough to produce a crop of any value. I do not regard it, however, as the object of nature to manure the land by rain (*this and other remarks would be modified were I to give present opinions*); one more important and practical is to purify the air; and there is enough of evidence to show us that plants entirely without organic matter may become covered with it, and also to show us that plants nourished even by rain-water only may be made to grow (*that is, without the soil to feed them*). This shows also the possibility of large quantities of impure matter being kept afloat in the air. Indeed, it is scarcely possible to obtain the vapour of water without some such impure matter. The organic matter found in the rain seems to be in perfect solution, and no doubt the more decomposed portion of it at least is entirely so, but an exception must be made of that which is alive.

It becomes clear from the experiments that rain-water in town districts, even a few miles distant from a town, is not a pure water for drinking; and that if it could be got direct from the clouds in large quantities we must still resort to collecting it on the ground in order to get it pure. The impurities of rain are completely removed by filtration through the soil; when that is done there is no more nauseous taste of oil or of soot, and it becomes perfectly transparent. The presence of free sulphuric acid in the air sufficiently explains the fading of colours in prints and dyed goods, the rusting of metals, and the rotting of blinds.

It has been observed that the lower portions of projecting stones in buildings were more apt to crumble away than the upper; as the rain falls down and lodges there, and by degrees evaporates, the acid will be left and the action on the stone much increased.

I do not mean to say that all the rain is acid; it is often found with so much ammonia in it as to overcome the acidity; but in general, I think, the acid prevails in the town. But, even if alkaline when it falls, it becomes acid on standing, and especially on boiling down, as the ammonia in these cases is separated from its acid.

A specimen taken in Greenheys fields, half a mile from the extreme south-west of Manchester, wind blowing west, had a peculiarly oily and bitter taste when freshly caught. A person to whom I gave some of it to taste supposed it had been put into a glass in which castor-oil had been put. I had collected the water in a large meat-dish, which had been very carefully cleaned, and was then set on a stand about two feet from the ground during the rain. Thinking it possible that some fatty matter might have been adhering to the vessel in spite of all my care, and not being inclined to believe that such an amount of impurity could be found in that place, I used a platinum basin, which was carefully cleaned, and, to prevent all mistakes as to organic matter, kept red-hot for some time. There was, however, no difference to be perceived from that collected in the larger vessel. The rain was very alkaline, and contained scarcely a trace of carbonic acid.

The subject of rain is, like air, followed up with details of experiments given in a tabulated form. Under the head of crystals from rain we have the following statements:—

That solid bodies are found in the air has at all known times been a part of the commonest information. Their existence has even been extended to all space, and worlds themselves have been theoretically made out of them. That they are an important part of the economy of nature we need not doubt; they are partly inorganic, partly organic, and partly organised. These are found to a hurtful excess in some atmospheres, and in others they exist, we cannot doubt, in exactly the most useful amount. We have already seen that salts of soda and ammonia are found in the air. It is extremely probable that these are as solid particles; indeed, we may feel certain. The beautiful discovery of Professor Tyndall that the solid bodies affect or cause the distribution of light is one of the many uses to which these still mysterious agents have been applied. When these bodies are organic they plant their own peculiar vegetation or animal life over the earth, and affect man and animals sometimes for evil, producing, as we cannot doubt, various diseases. We shall probably learn that their

usual effect is for good. As we rise high in the air on the mountain-sides they diminish in quantity, showing that they gravitate like other bodies; this was proved by Pasteur of organisms, and a friend of mine tells me that the animals on the high Alps are peculiarly attracted by salt, as if the height prevented the usual supply in the rains. One of the uses of storms seems to be to supply the world with salt.

The history of this subject is a long one; it would take us into early Greece and drag us slowly to Rome, and through many dark portions of the Middle Ages. It would even keep us wandering over all Asia and on towards the poles in the eastern and western worlds. It must not be written here, but I cannot forbear giving the picture drawn by Lucretius; it is wonderfully vivid. In another part will be given a quotation from Terentius Varro. Lucretius may be taken as a clear exponent of the existence of solid bodies in the air, and Varro of the belief in the organised character of some of them. For the present I shall be content with showing how old are the ideas.

From the invisible atoms of Leucippus to the motes in the sun we have abundant mention of bodies in the air. Lucretius says:—

"Observe whenever the light of the sun pours its rays into the dark part of houses; you will see in the very light of the rays many minute bodies in the empty space, mingled together in many ways, and, as it were, in perpetual conflict; battles without pause, with many meetings and separatings, so that you may conjecture from this spectacle what is the quality of the tossing undergone by the primary particles of things in the great void. A small thing may serve as an example of great things, as the footsteps of knowledge. On this account it is more proper that you should give your attention to those bodies which seem to crowd confusedly in the sun's rays, because such confusions point to secret and unseen movements of matter. For you will see many struck with unseen forces, changing their course, driven backwards, now to this and now to that, and finally in all directions. Doubtless this erratic motion arises from the primordial particles, for the first Primordials are moved of themselves."—A little altered from the translation by Rev. John Tilly Watson.

> Contemplator enim cum solis lumina cunque
> Insertim fundunt radios per opaca domorum;
> Multa minuta modis multis per inane videbis
> Corpora misceri radiorum lumine in ipso;
> Et velut eterno certamine prœlia, pugnasque
> Edere turmatim certantia; nec dare pausam.

Dr. Angus Smith's work would have been like a fable without the moral, or a didactic discourse without the application, if he had not spoken of ventilation; with regard to which he states:—

It is often asked how much fresh air we must allow to come into a room in order to keep it wholesome; so far as carbonic acid is concerned, some information has been given; but the amounts vary so much that we shall never be able to answer the question as it arises in all its changes, unless we consider our reasons for ventilating.

The first is certainly the dislike to organic smelling substances evaporated from living beings. As some of them are very volatile, a very little rise of temperature increases their amount; and in warm weather we require change of air so frequently, that we cannot make any use of the carbonic acid test. The amount of change is infinite; we require it for every breath, and we do not consider whether a door is sufficiently open; we open all doors and windows, or leave the house entirely.

Let us take the other extreme—a very cold [illegible] Eskimo [illegible] hut. The amount of [illegible] wonderfully small; we do not [illegible] the carbonic acid may rise, [illegible] very high. The organic matter [illegible] condensed on the [illegible] as a solid, and in a form not to affect the smell. For a similar reason we require less ventilation in cold weather: it is not foolish, as some will endeavour to persuade us, to take less, but it is a natural instinct. We object to the cold, and we learn that heat is a more pressing want than even pure air, whether the organic matter affects our senses or not.

The next reason for ventilating is allied to the first; we say it is to produce freshness. This means that, although all the air of the room be quite new, it has received a something from the *surfaces* in the room which must be cleared out. This is the reason that housewives like to keep the doors and windows open, and allow the air for a time to blow through the house. This process removes the last particles from the furniture, and is that finish which polishing cannot give. If the undefined impurity exists in large quantities, only rubbing can remove it rapidly, and this is done when we clean thoroughly walls and furniture. If very bad, and time presses, whilst elegance is not a demand, we cover the whole, and find whitewashing to be a ready mode.

The other reasons for ventilating have arisen from scientific inquiries. We wish to remove the carbonic acid; we might be able to find this gas by the senses if it were very abundant; but it is not so as a rule until after our senses have informed us of the organic accompaniments. It furnishes, however, one of the most important, and probably the most important of the reasons in every-day life, because carbonic acid is the most rapidly hurtful to animal life of all the emanations from the person. It lowers the vitality rapidly, and kills with indefinite warning. The best warning is the organic matter, which acts for both. The warning by carbonic acid is called indefinite because people lose vitality, but do not observe that the cause is in the atmosphere, there being no smell connected with that gas. At night, when lights are burning, the carbonic acid warns better than the other impurities by simply putting out the candles. This seldom occurs in private houses, but dim burning is common enough. Mr. James Napier, F.C.S., tells me that he has seen the candles beginning to go out in a small meeting-room in the country which had a low ceiling and was crowded. It was needful to keep the door open. How blunt, then, is our perception of carbonic acid!

Another reason for ventilating is to remove solid floating bodies, including infectious matter, fungi, and peculiar emanations arising from disease or other anomalous conditions. These floating bodies can sometimes be distinguished by the sense of smell—in the case of mould, for example. If it were possible to describe a smell completely, this class would be largely subdivided, since experience has made many persons very learned on this subject. It is, however, a knowledge which we have not yet been able to receive from or communicate to others. This whole question requires careful examination. The knowledge of the smell cannot be taught, but it may guide us to much that can be taught. Ventilation for this class of bodies will be probably much more attended to in future; care must be taken to drive them to the nearest opening, and not to allow them to diffuse themselves through the room in which they may be produced. In some cases resort must probably be had to rapid artificial and heated currents.

We ventilate to remove smoke and ordinary dust; these are easily seen; and we use ventilation to procure dryness. Moisture rises constantly from the skin, and if an inhabited apartment is not ventilated that moisture accumulates. By opening the windows we cause floors to dry sooner, and we remove moisture from all the apartments, and that moisture has generally organic matter with it. If we ventilate with very moist air we shall dry nothing; if we have very dry air we may dry too thoroughly. It is, however, better for us to have what is called practically dry air—that is, air capable of containing much more moisture than it has. The amount of drying work done is according to the dryness, warmth, and speed of the air; with little of these qualities a great bulk of air is required where otherwise a small bulk might have sufficed. By warmth and dryness we have an advantage in requiring less rapid currents. I have said elsewhere that a climate has a certain advantage from being very rainy. To call dryness an advantage is not a contradiction. When rain falls down and washes the air we can feel the benefit; when the substances floating in the atmosphere are dried up we can imagine the advantage; but when the air is kept loaded with moisture which does not fall as rain, and is not carried off by wind, we can easily understand why the results should be hurtful. That it is not the watery vapour itself that injures may be learnt from dye-houses, where men spend their lives in all conditions of dampness, sometimes in steam dense enough to make it difficult to see to the distance of a yard. There they have not the heavily-laden moisture of hot damp climates with rich vegetation, and they have abundant warmth, so that the moisture is not used for absorbing heat and producing colds.

In a very temperately, and I may say beautifully, written pamphlet by Dr. De Chaumont on "Ventilation and Cubic Space," he discusses the amount of air required for 1000 cubic feet for an individual, and refers to a discussion on the subject which had about the time (1867) taken place.

He says, p. 9:—

"Now to attain this minimum, that is, to ensure the carbonic acid ratio never rising above ·06, we must supply 3000 cubic feet per head per hour; for, taking Professor Donkin's formula.—

$$r = p + \frac{P}{A}, \text{ when } r = \cdot 0006,\ A = 3000.$$

Here p = carbonic acid per cubic foot.
P = ·6 carbonic acid given off by one adult in an hour.
A = delivery of fresh air in one hour.
r = ratio of carbonic acid desired (in this case ·0006 per foot)."

We must here close our review of this very valuable and comprehensive work, which, instead of being modestly entitled "The Beginnings of a Chemical Climatology," should be "An *Advance* in Chemical Climatology." We cannot, however, part with the work without stating that, notwithstanding the considerable extent of our quotations, it has yet many more points and questions which are both interesting and instructive to the sanitarian, with results of detailed experiments given in a tabulated form, the book being one of 600 pages.

Essays in Astronomy. A series of papers on planets and meteors, the sun and sun-surrounding space, stars and star-cloudlets, and a dissertation on the approaching transits of Venus; preceded by a sketch of the life and work of Sir John Herschell. By RICHARD A. PROCTOR, B.A. Camb., Honorary Secretary of the Royal Astronomical Society, &c. With plates, and twenty-four drawings in wood. London: Longmans, Green, and Co. 1872.

MR. PROCTOR'S merits as a scientific writer are so well acknowledged that it is scarcely necessary to praise any work proceeding from his pen; but in order to keep our readers *au courant* with the scientific issues from the press we now present them with a general notion of the contents of the book, and we scarcely need to mention that it is one of the highest merit.

Mr. Proctor's own statement in regard to this work is that it is a collection of those essays to which he has had most frequently to refer in other works, and particularly in "The Sun" and "Other Worlds than Ours." A certain degree of inconvenience is occasioned to readers when references are made to articles

published in different serials, and still more when the reference is to essays published in the "Proceedings" of scientific societies. He therefore considered it desirable to gather together those scattered papers, and, after submitting them to careful revision, to publish them in a single volume. The welcome extended to his "Light Science for Leisure Hours," in which a series of papers covering a somewhat wider range of subjects had been similarly collected, further encouraged him to the course he has adopted.

The first three essays in the present volume (though the third is entitled simply "The Study of Astronomy") relate to the life and work of the great astronomer and philosopher (Sir J. Herschell) whose loss science has recently had to deplore. Then follow papers on the planets Mars and Saturn. The subject of meteoric astronomy is next treated at considerable length. The recent action of the Astronomical Society in awarding its gold medal to Schiaparelli for his researches into meteoric astronomy has attracted considerable attention to the subject, and has, as it were, sanctioned theories which were viewed somewhat doubtfully when the accompanying essays were written. The papers on the zodiacal light and the solar corona are chiefly taken from the "Proceedings of the Astronomical Society." They present views which have been confirmed, since those papers were written, by many striking discoveries. The remaining essays in the body of the work relate to the stars and star-cloudlets, their nature, movements, arrangement in space, and aggregation into systems. The appendices contain notes on the rotation of Mars and the proper motion of the sun, which Mr. Proctor deemed somewhat too abstruse for the body of a popular work like the present, as well as three essays on the approaching transit of Venus, which for a like reason seemed more suitably placed at the end of the volume than elsewhere.

The relation of the essay on equal surface projections of the globe to the more specially astronomical subjects, Mr. Proctor states, will be obvious when his use of equal-surface projections, as a means of ascertaining and interpreting the laws of stellar and nebular distribution, is taken into account.

It being found impossible to include in a single volume all the scattered essays which seemed necessary either for purposes of reference or to supplement the information contained in "Other Worlds" and "The Sun," the essays have been separated into two divisions, one including the more strictly scientific essays (with a few exceptions), and the other containing essays of a somewhat lighter kind, and more closely associated with the subject of the plurality of worlds. The former series constitutes the present volume, the latter will, it is stated, be shortly published, uniform with "Other Worlds," "The Sun," and "Light Science," under the title of "The Orbs Around Us."

Mr. Proctor thanks the editors and publishers of the various serials from which these essays have been taken for the permission to reprint them, and especially the Council of the Royal Astronomical Society, as well for leave to reprint the essays from the Society's "Proceedings" (which constitute more than two-fifths of the present volume) as for the permission to use the woodcuts and lithographic engravings belonging to the Society.

These illustrations are worthy of the text which they accompany, giving additional value to a valuable work.

Natural Philosophy for General Readers and Young Persons. Translated and edited from Ganot's "Cours Elémentaire de Physique" (with the author's sanction), by E. Atkinson, Ph.D., F.C.S., Professor of Experimental Science in the Staff College. London: Longmans, Green, and Co. 1872.

Dr. Atkinson states that this is not a mere translation, but such additions and alterations have been made as he thought fitted to render the book useful to the classes for which it was more especially designed—namely, as a text-book of physics for the middle and upper classes of boys' and of girls' schools, and as a familiar account of physical phenomena and laws for the general reader. In range it may perhaps be fairly taken to represent the amount of knowledge required for the matriculation examination of the London University.

Although English scientific literature is not wanting in works in which the main physical phenomena are explained in familiar language, they are for the most part—whether from too much conciseness in some parts or from too minute details in others, or again as being too costly—not suited for direct teaching purposes.

To facilitate reference the articles of the present work have been numbered, and a copious index has been drawn up in accordance with this arrangement.

We can confidently recommend this as a valuable addition to our elementary treatises on technical science.

The Earth's Crust; a Handy Outline of Geology. By David Page, LL.D., F.G.S., &c., &c. Sixth Edition. William Blackwood and Sons, Edinburgh and London. 1872.

This is a new edition of a valuable elementary work; suffice it to say it is an improvement on former editions, the merit of which are well acknowledged, indeed the author's name is a valued guarantee for the worth of the book, which is truly a pocket one, and, therefore, all the more valuable, considering the objects it seeks to accomplish.

A Lecture on Science and Fevelation. Delivered in the Rooms of the Royal Institution, Liverpool, and the Philanthropical Society, Leeds, on Concluding a Course of Lectures in Meteorology for the North of England Council for the Education of Women. Second Edition. London: Longmans, Green, and Co. 1872.

The set of lectures to which reference is made in the opening paragraph of this little work consisted of a series of Educational Lectures on Meteorology, delivered for the North of England Council for the Education of Women, in connection with the Ladies' Educational Association of Leeds and Liverpool. The course was, it appears, attended by between 200 and 300 ladies in these two towns, and from the majority of these the author received written answers to the questions set weekly on the subject of the Lectures.

The following Lecture, which formed the conclusion of the strictly scientific series which preceded it, has been printed at the request and for the use of some of those who attended the course. And the first edition, having become exhausted, it has now been reprinted with the addition of one or two paragraphs. It is well worthy of being read by all who take an interest in the subject of which it treats.

The Strains in Trusses, computed by means of Diagrams, with Twenty Examples drawn to scale. By Francis A. Ranken, M.A.C.E., Lecturer at the Hartley Institution, Southampton, formerly Assistant-Engineer on the Cambrian Railways, &c. London: Longmans, Green, and Co. 1872.

This is a valuable little treatise (69 pages) on the subject of trusses and analogous structures, just the kind of thing required by practical men, for the author has dealt with his subject in strict accordance with the promise of his preface, in which he states that he has endeavoured to set in a clear light the theory and method of computing by diagrams the strains in trusses bearing a constant load, without taking into consideration the subject of transverse strain. While treating only balancing systems of forces in one plane, each system acting on a point, he has purposely avoided introducing the principle of moments, wishing to confine himself to the results to be deduced from the parallelogram of forces. He has tried to avoid everything that might give the appearance of difficulty, and he hopes that what he has written may be found intelligible even by those who have no previous knowledge of statics. In doing so he has made use of the assistance of others when necessary, and he thanks Professor Fuller, of University College, for several suggestions. It would be useless to attempt to quote from this work without the aid of diagrams. We must therefore content ourselves with stating that it contains chapters on balancing systems of three forces, roof trusses, balancing systems of more than three forces, roof trusses continued, girders, and bridge trusses.

(*Continued on page* 122.)

THE ALPINE PORTE-KNAPSACK.

The knapsack itself is like an ordinary waterproof one, but is fitted with light stiffening canes, to allow of contraction in size, and of simplicity in the fastening of it.

The porte-knapsack has a very light cane frame or yoke (*y*) to keep the bearing webs in *tension*.

The whole of the weight, instead of dragging as usual from the *front* of the shoulders, is carried *upon* the shoulders by these tension webs (*t*), except what is distributed on to the back, by the back webs (*b*) resting gently against it.

The webs should be buckled just tight enough to keep the cane yoke (*y*), and the cross cane struts (*c*), at about the angle shown on sketch, when in use. If not tight enough the knapsack will have a tendency to slip off, if too tight it will not fit pleasantly.

The proper adjustment is when it will just lodge on the shoulders and back, without the aid of the fastening straps (*f*), which are required to keep the load from jolting off, but which still allow perfect freedom from strain and leverage.

These fasteners, fitted with the usual hook and eye (*h*), should be buckled as short as they will go, without being tight enough to *press* against the front of the shoulder.

When not in use the shoulder yoke and the cane cross struts may be kept folded close on to the back of the knapsack by passing these fasteners behind the tension webs and hooking them into each other.

The small neck strap (*n*) should be tight enough only to keep the back of the cane yoke well off the neck of the wearer.

The patentee of this invention is Mr. William White, F.S.A., and the maker, wholesale and retail, is Charles Price, 33, Great Marylebone Street, London, W. The price is stated to be 30s.

The Scientific Review

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THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON.

ESTABLISHED 1ST MAY, 1862

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Chairman of the Council:

SIR ANTONIO BRADY.

The Session 1871-72 is now ended

Members whose subscriptions are now due will please to forward the same to the Collector, Mr. G. A. Stretton, 4, St. Martin's Place, Trafalgar Square, London

Monthly Notices.

Dr. Hooker and Mr. Ayrton.—Electrical Soirée at the London International Exhibition.—Opening of the Bethnal Green Museum—"Naval Science."—The "Mining Magazine and Review"—Technical Education.—Death of Mr. W. Bridges Adams.—New Patent Law in Canada.

PROMINENT amongst the topics of the month is the affair of Dr. Hooker, of Kew Gardens, and Mr. Ayrton, the First Commissioner of the Government Board of Works. As only the case for Dr. Hooker is now before the public, we cannot at present do more than notice the existence of the dispute referred to, though we must own that *primâ facie* our sympathy is with the valuable old servant of the public, who has done so much for practical botany and its popularisation, rather than with the right honourable gentleman who was once styled by a well-known political character as "Commissioner of Dirty Works," and is well known to have sustained the part of Marplot to the movement for fully securing Epping Forest in its entirety for the use and enjoyment of the public.

The London International Exhibition has been progressing very favourably, and has earned for itself a high character as a place of instruction and amusement for the members of the *haut ton* and West-Enders generally; but at the same time it has afforded an additional proof that its *locale* and general character, like that of the kindred institution, South Kensington Museum, render it altogether unfit as an efficient aid to the instruction and recreation of the masses. Perhaps, after all, the Science and Art Department is right in devoting its attention to improving the taste and science of the upper classes rather than the other classes of society; for the tastes of the latter are usually of a natural and common-sense character, and therefore do not require the rectification that the extravagances of the former have need of. Considering the position and action of the Exhibition to be such as we have described, a soirée on the 18th July was a very noteworthy occurrence, and might be aptly termed a great gala day of practical electrical science. Mr. William Preece was the lecturer. Before the lecture was concluded messages were interchanged between one of the tables in the arena and Teheran, as well as with an Indian station, from which came the intelligence, "Locusts swarming in Scinde; Sutlej bridge destroyed by floods." A message of compliment and congratulation, addressed to the Prince of Wales, was also received from the Persian Prime Minister, in return for one of a like kind sent from the Albert Hall. When the speaking was over, and a vote of thanks to Mr. Preece had been passed on the motion of General Scott, the company dispersed about the building and the conservatory of the Horticultural Society. Mr Varley showed, in the arena of the hall, his mammoth battery of a thousand cells; and a torpedo, or something mildly representative of that instrument of war, was exploded by an electric current. The effects of Mr. Varley's battery, with which he charged some large tinfoil condensers, were more like those of frictional than galvanic electricity. The condensers when discharged gave a sharp report and brilliant spark; and the intensity of the discharge was so great that it blew short lengths of the very indestructible metal, platinum, into a fine cloud of metallic steam. Altogether, the evening was one of the most instructive ever devised in connection with instruction and amusement

The opening of the Bethnal Green Museum is another recent event. This institution, which owes its origin to the exertions of Sir A. Brady, Rev Mr. Septimus Hansard, and others, has been placed under the jurisdiction of the South Kensington potentates, and will, it may be hoped, do much for the real workers in the way of instruction and pastime. It is, however, essentially local and sectional, and not metropolitan and general. Although antipodean to Brompton, it is not central; and the great bulk of the metropolis are no better off now it is established than they were before it had any existence

"Naval Science," a quarterly, edited by E. J. Reed, C.B., has now arrived at No. 2, which contains many articles of interest, and, as might be expected, much that is favourable to Sir Spencer Robinson and the editor. One thing, however, is clearly apparent, that whatever opinion may be formed of Mr. Reed's merits as Constructor of the Navy, no one can doubt his fitness for the editorship of a journal of naval science of the highest standard.

The seventh, which is the current number of the "Mining Magazine and Review," edited by Nelson Boyd, F.G.S., &c., contains, amongst other matters, interesting articles on Torbanehill Mineral, on the Southern Fringe of the South Staffordshire Coalfield; on Colorado Territory—its Aspects and Mineral Resources; and on Coal Oil and Petroleum.

The subject of Technical or Technological Education is again on the *tapis*. This time it is the Society of Arts that is moving in the matter, a meeting having been held by that body on Saturday, the 20th of July, when it was resolved that the cooperation of the City Guilds and other corporations should be invited; a resolution to that effect being moved by Mr. Watney, Master of the Mercers' Company, and supported by Mr. F. W. Campin, who is a liveryman of a principal company.

We regret to have to announce the death of Mr. Wm. Bridges Adams, the well-known Civil Engineer and writer on practical science. We hope to supply our readers with a memoir of his life in our next.

The Canadians have at last seen the wisdom of adopting a liberal policy in regard to the protection of inventions, and passed a new law by which any inventor can now extend his patent rights to Canada.

REVIEWS.

(*Continued from page 120.*)

A Letter to the Right Hon. G. J. Goschen, M.P., First Lord of the Admiralty on our Iron-clad Fleet. By E. GARDINER FISHBOURNE, Rear-Admiral. London: Spon, Charing Cross.

PROBABLY we shall best convey to our readers a general idea of the contents of this letter by placing before them Admiral Fishbourne's introductory note:—

The country and its navy are much indebted to you for having granted the *Megæra* Commission.

But, permit me to say, grave as the circumstances connected with the fate of the ship *Megæra* are, and imminent as the perils passed through by her crew have been, they are as nothing compared with the condition of many other ships, or with the dangers of the system upon which those ships have been designed.

A remedy for this dangerous and defective system would evolve an indefinite increase of efficiency in the whole navy, would rescue men and officers from peril, and effect the saving of enormous sums of public money.

Circumstances that could not have been believed, had they not occurred, have taken place, such as are without parallel in the history of the world, not simply as respects large ships of the past, but as respects even small ships.

Seven enormous ships, of thousands of tons each in measurement, actually on their first trial, in official phrase, found to be unseaworthy from their being deficient in stability, and when made safe by placing from 350 tons to 500 tons of ballast in their lowest compartments, the two gentlemen most responsible for their condition and qualities coolly say that this great amount of ballast only placed the centre of gravity where it was intended to be; and, as if this were not enough, the designer further claims credit for having omitted from their hulls during construction the weight which he implied occasioned this disastrous condition, on the plea that he thus saved the cost of a large weight of expensive iron, which necessitated to correct the position of the centre of gravity disturbed by this omission, only to be replaced by inexpensive ballast.

Marvellous! to claim credit for weakening the bottoms of these ships, that ought to be the strongest of the strong, by the omission of large quantities of iron, destroying thus their efficiency, risking many lives, and the loss of ships that cost about £300,000 each, or a total of about two and a half million pounds sterling, with the chance of saving the paltry sum of ten or fifteen thousand pounds on each.

Could we have believed that anything so atrocious could be done as to omit 350 tons of iron from the bottoms of these ships, or 700 tons from a greater height (and if from above less would not balance the 350 tons of ballast put in below), our fears would have been set at rest by the facts which prove incontestably that no weight on the whole was omitted, whatever amount may have been omitted from their bottoms, inasmuch as the ships were designed to have a mean draught of 20 feet 7 inches, whereas they actually drew 22 feet 6 inches.

Therefore the language used by these gentlemen does not represent a fact, but merely a crude opinion offered in an attempt to account for that which was but the necessary consequence of adopting radically erroneous systems of design and of calculation.

What these ships were designed to be and to possess, and what the facts prove concerning them, may be shortly stated under the following heads.—

Ships designed to possess great stability—yet possessing so little as to be pronounced "unseaworthy."

Ships designed to have little tendency to [illegible] to effect this object cardinal properties [illegible]rificed — yet the ships rolled so [illegible] that fears were entertained that they would roll over though scarcely moved out of harbour.

Ships supposed to have been lightened by 350 or 700 tons were, on the contrary, found to have their weight increased by 350 tons of expensive iron, and to require 350 tons of ballast to make them safe—making a difference between one estimate and the fact of 1050 tons!

Ships designed to be of light draught for special services — yet drawing 2 feet more than the designed draught.

Ships whose centres of gravity were raised to the extreme point of danger on the plea that they should not roll much, and that they should possess a steady platform for their guns—yet found to possess these and other essential qualities in a higher degree from having their centres of gravity lowered by the enormous amount which 350 tons or 500 tons of ballast placed in the lowest compartment of their bottoms would effect.

Ships of enormous weight and of enormous cost, liable, in the chapter of accidents or in the exigencies of service, to be grounded, have had their bottoms made so weak that they are unable to bear the weight of the ship, although placed on the bottom with care and under favourable circumstances.

Ships estimated to cost, according to the estimated weight of expensive iron, a large sum, have cost many thousands more for first cost in additional weight of expensive iron; the price of 350 tons of ballast has to be added, together with the expense of alterations.

Other large ships of great cost, designed on the same enormous system, intended for service in the West Indies, are now found unsafe for more than home service in fine weather, going only from port to port, and even in this case care must be taken that they do not swamp like jolly-boats of the olden time.

The best of the ships on this design roll through such large arcs as to expose a depth of from 10 to 15 feet of their unarmoured sides and the whole of their unarmoured decks. Thus they become an easy prey to small gunboats that might be pushed off from the shore, or to small rams that would pierce their bottoms, for there is seldom more than a thin skin to be pierced; this could be readily done by small pieces with steel shot, which could be fired at any angle and with sufficient precision in any sea.

Just as we are assured that a knowledge of the cause of and the cure for rolling are obtained, the *Times* correspondent reports angles of roll so enormous as to be without parallel in naval history, in the explanation of which the system of cure is wholly abandoned, I dare say unintentionally, but such is the fact! and we are informed that the main cause is that the vessels were steaming so slowly—I suppose it was only meant as a covert reproof of the Government for their parsimony in prohibiting the expenditure of coals to obtain a higher speed—and this result is called science.

Were we obliged to admit that this was but the usual course of the trial and error which we are obliged to submit to in the progress towards truth—that these things were but the necessary or even occasional results of scientific operations — it would be one of the most humiliating obligations in the whole range of mechanical science; but happily it is not so.

The system, the working out of which has led to these disastrous results, is contrary to sense and to science.

It fails to represent the facts in relation to the behaviour of ships at sea, it is opposed to the experience of sailors, and it is contrary to the views of the most approved writers on naval architecture and of living naval architects.

This system, without any tentative process, and without the concurrence of persons of competence and experience, has been smuggled wholesale into our navy, at a great expense to the country, only to do great damage to our ships.

Some one is to blame and ought to be held responsible; or, better still, some one ought to be held responsible that such a state of things should neither continue nor recur after being once suppressed.

I would respectfully suggest the appointment of a royal commission to inquire into the circumstances, to take evidence and place the facts before the public, not so much to inculpate anyone or to distribute blame, but that the remedy sought for may be found.

To continue to build ships on such principles, or to permit those built to remain unchanged, is to throw away immense sums of public money, to place in danger many lives, and to court national disaster.

The appointment of such commission becomes more urgent, for to remedy the matter it has been determined to instruct naval officers in the science of naval architecture, then, if the system which has produced the sad results we have before us, be taught as science—and I perceive that to be the object of its partisans—the remedy will be worse than the disease. Better far scramble the money at Greenwich, or throw it into the sea, than apply it to such a purpose.

This commission should not be composed of political, scientific, or professional persons who have in any degree committed themselves to the approval of the principles or schemes to be examined, or of persons who have approved of ships constructed on such principles; this is so obviously necessary in forming an unbiassed opinion, that it would be unnecessary to mention it only that such selection was quite overlooked in the formation of the committee on naval constructions.

The commissioners should be men who will not step aside to consider the interest of persons or of political parties, but who will consider and recommend only that which is best for the permanent interests of this great nation.

I trust you will not think that it is any want of respect for your high office, or for yourself, that induces me to address you through the public press.

I do so because I thought your professional and semi-professional advisers too deeply committed to be able to give a dispassionate opinion, and very unlikely to entertain an opinion, on such a subject, that emanated from a naval officer; and further, I knew the difficulty of your acting without the concurrence of these professional advisors, who, it is my opinion, have before now improperly sought to subordinate even the Lords Commissioners of the Admiralty to their *dictum*.

Moreover, I felt it to be a national question, which, from what had taken place, became, if possible, more national, and therefore ought not to be shut up in a mere official document.

The examination of this question by properly-appointed commissioners would also be important to those of the mercantile-marine of the country who have been misled by the activity of the admirers of the wrong system, which you will find exposed in the accompanying letter.

As I could not reasonably expect the press to publish matter containing lengthy technical statements, I have arranged this communication in the form of a pamphlet, which I have requested Messrs. Spon, of Charing Cross, to forward to the Admiralty.

We trust this letter will receive from our First Lord Commissioner the consideration it deserves.

Knapsack Manual for Sportsmen on the Field. By EDWIN WARD, F.Z.S. London: Published by the Author, 49, Wigmore Street, Cavendish Square, and Bradbury, Evans, and Co., 10, Bouverie Street, E.C. 1872.

As the author well observes, the gentleman who is a true sportsman, seeking his game far afield, is a pioneer of science, whose operations are valuable generally in proportion to his possession of a knowledge of natural history, that is, such knowledge as may enable him to utilise his opportunities of observing [illegible] [illegible] that may never occur to others [illegible] objects and facts that may

never have been under intelligent observation previously. Opportunities like these, if wasted, seldom, or perhaps never, recur; and it is difficult to estimate the possible loss to science in such a case. Perhaps a discovery, or the disputing of some false, accepted record, may be retarded for a century. But the cultivated faculty of observing is not all that is wanted. There are technical facts in connection with the collecting of specimens to illustrate natural history which are necessary for the sportsman to know, if he wish to more effectually aid scientific progress, while, at the same time, he enhances his own gratification. For instance: a sportsman, when far away from cities or civilisation, and relying on himself, may secure a particular animal, may rightly estimate its novelty, rarity, or value—have tact and intelligence to make and record his observation; but for lack of technical knowledge may be unable to preserve for other eyes than his own the specimen it has been his fortune to meet with. These views and opinions have, it appears, been the moving springs of action in the author's present work, in which he conveys valuable information, particularly that derived from his own experience, in a form that shall be useful when and where it is wanted—not at home, where help can be readily commanded, but on the field. The work indicates where game may be sought—what should be done to best preserve the trophies obtained—explains how they may be prepared to represent the living creatures. A suggestive classification which may be applied to make a home museum is added.

The author considers that his last division of the plan has a bearing on all of it, and, therefore, he inserts it in a book professedly designed for use on the field. It may serve to indicate to the traveller, or to remind him of, what objects he may wisely collect or save; each of which may in degree serve as a type, and, by its position in a series, have a value that alone it does not possess. Many of the trophies brought home may thus become prized as an intelligible collection, rather than be a mere assemblage of isolated specimens. In one part of the book is made known matters that can be conveyed by these means, of how the application of an animal's natural features to an artistic model, in order to reproduce life-like effect, can be made to achieve vigorous and truthful representation, in which art and originality of design may have play. Mr. Ward anxiously advocates that the treatment of specimens of Natural History should be an art; and hopes to see the too-familiar practice of "stuffing" left to its proper rank, even in public estimation. We commend this little book to all travellers, and particularly those who like natural history.

Steering and Propelling of Iron-clad Ships of War. By a Member of the Inventors' Institute, April 30th, 1872.

As we are always anxious to afford every inventor and pioneer in practical science (and especially those who are Members of the Inventors' Institute) the opportunity of presenting his views to the public, we have much pleasure in noticing this little pamphlet, which we commend to the consideration of our readers.

The following extracts give the main points referred to in this treatise:—

The following paper treats of the manœuvring and propelling of iron ships of war in future naval engagements, and an improved kind of combined steering and propelling machinery that would be best in use in all our ironclad ships. Also suggestions upon the late disasters which happened to the Lord Clyde and other iron ships of war, and which should be a warning to those in authority in this country to adopt a more efficient method of [illegible].

It [illegible] that in adopting a safe and [illegible] steering and propelling [illegible] a great advan-tage is gained over an enemy. For instance, a vessel may manœuvre and get out of the way of the ram of an enemy, and at the same time make a dash at the enemy's ship and damage it very much.

I can prove other good reasons why such a system of a quick steerer-propeller would be of great advantage to any iron ship of war. I will name it hereafter; and next give a short description of the proper kind of combined steering and propelling machinery which should be used on war ships, and the best place in them to fix the same.

Firstly.—The steerer-propeller apparatus should by all means be placed as low down in the water as possible, and it should be placed inside the ship, and the machinery very low down, for various and important reasons.

1st.—That the propeller would be quite safe, and out of the way of shells, shot, and steam rams.

2nd.—That when so placed the resistance of the water against the propeller would be much greater, and the vessel would attain a higher rate of speed; for it is proved that the deeper down in the water compressed air is driven into a tube, the greater the pressure of the same on the bottom of the tube. "Consequently the speed of any vessel so propelled is much greater than when putting certain other kinds of propellers at a much less depth." I will name, for instance, the "Improved Centrifugal Propeller." This would be found to drive a vessel much faster if placed deeper in the water, and the waste of power much less. Also a saving in fuel would be effected by the vessel moving at a greater speed.

If the centrifugal propeller were used in an iron war ship, a suitable invention should be put on the inlet pipe to prevent all substances from entering and fouling the propeller. I also think that the bearings of the centrifugal propeller may be very much improved on, and made to last a greater length of time, and used thus on iron ships of war would be invaluable. From the propeller, out at the stern of the ship, I should place a suitable tube, with two or more slide valves, so that by opening the one and closing the other the vessel might be steered and propelled in any direction whatever. I also suggest as an extra steering machine, for safety and quickness sometimes, the use of an auxiliary apparatus, to avoid an enemy's steam ram, and at the same time to make use of the extra superior steering power to take advantage of the enemy, either to sink or injure him by your steam-ram.

The machinery I would have in use for the auxiliary steering apparatus I will now describe.—

1. A long cylindrical-shaped air vessel. The air to be compressed into the same by suitable condensing pumps, and these to be worked by steam.

2. Two pipes put out at each side of the ship near the stern and a slide valve on the end of each tube.

3. At the bottom of the air vessel a tank placed full of water, and into this the compressed air will rush, driving the water out into the sea on either side through whichever valve is open, moving the vessel to and fro with quickness and ease.

This auxiliary steerer should only be in use on an extraordinary occasion, when danger is nearest at hand. I think that this kind of steering and propelling of ships of war is greatly superior to the twin screw now in use, the above plan being far more safe. The auxiliary steerer would be a very great advantage in a naval battle. The centrifugal propeller, etc., must be worked by steam at a high speed, and the said engine should be very economical in fuel.

I think the best and most advisable plan would be to prove by experiment the safest and most perfect kind of combined steering and propelling apparatus that the Patent Office can supply either from models or plans, and it would certainly be a great and important thing to settle the matter at once, by getting a committee of the House of Commons and taking evidence on the above subject: the said committee to select about fifty or more of the best combined steering and propelling machines from the Patent Office or elsewhere. If certain experiments, above suggested, were fully tried by the Government upon these safety inventions, and any of them fitted to certain ironclads after such trial, they might be adopted into the Queen's navy with the advantage of much saving of life and pecuniary loss even in times of peace.

But should this important matter be neglected, and the rudder and common screw be allowed to remain as at present, the inevitable consequence in the next naval battle will be a great naval disaster, and the cry somewhat such as that of King Richard III. in the battle of Bosworth Field.

I will next relate how superior an ironclad broadside vessel could be made to the Monitor system, viz., by adopting the before-mentioned steerer-propeller, which would give a broadside ship greatly superior powers of manœuvring either against ironclads or forts. We will suppose, for instance, that two broadside ships are engaged in battle, one of them is fitted with an improved steerer-propeller, and the other has only a common rudder. The former ship would act as follows:—A whole broadside being fired at the enemy, say at one quarter of a mile distant, the ship could then be quickly manœuvred round whilst the gunners were reloading, and thereby keep up a succession of firing with much greater rapidity than the old method now in use, giving a ship of war an increased advantage over an enemy. The above plan of fighting and steering quickly would also be another advantage in attacking forts; and successive broadside firing, giving the ships superiority over the Monitor system of firing in many respects. It can also be easily managed by the twin screws. But in war the latter may soon become injured or broken by shell or shot, or should one get out of order by fouling with the ropes the other would be rendered useless. So that by adopting a quickly-acting steering and propelling apparatus, placed inside the ship very low in the water, it could neither be fouled nor injured by any means from the outside.

The appliance of the steerer-propeller to ironclads in war-time may be of great service in preventing a ship's being struck by a moveable torpedo of any kind, and avoiding it by manœuvring quickly about. The running torpedo would be more likely to sink an ironclad at anchor than otherwise, or if she were moving along even slowly in the water the self-moving torpedo might possibly strike and sink her. But an ironclad at full speed, quickly and constantly manœuvring about, would steer away safely from any self-moving torpedo at a distance of 50 yards. The greatest distance that these self-moving torpedoes will act against a war-ship at anchor is at the present day from 300 to 500 yards, viz., from the spot where the torpedo is started to the ship at which it is to strike. The best thing for an ironclad to do is to keep at a distance of 50 yards or more from a torpedo-ship, or from any place where these machines are supposed to be in readiness for action, so as to avoid the danger of being sunk by them. I have no doubt that in the next naval war torpedoes will be very much used, and with great effect sometimes against ironclads. Should the latter have any such on board they must be kept at a safe distance.

It seems very plain now that the great naval Powers will be obliged to adopt a quicker steering apparatus, and the first that does so will obtain a great advantage over that one which does not in any future naval battle, and probably lose it by not doing away with the common rudder and screw.

But before all the above plan of naval manœuvring, etc., can be carried out, the old rudder and screw must be entirely superseded by a better steering apparatus, for such improved tactics could not be managed with them. I will mention several disasters which have taken place during the last three years

to some of Her Majesty's ironclads, showing very plainly that even in times of peace the common rudder is of little use in channels where rocks are known to be, and such disasters taking place just at present, possibly they may be a means of warning to the rulers of the nation to adopt better plans for steering their valuable vessels in future; for it is now the fact, during the last three years, that we have lost one ironclad and all hands, and four or five other war ships, which have been either stranded or struck against the rocks, showing that our English heavy ironclads cannot be steered free from danger with their present machinery, neither in the vicinity of rocks nor in narrow channels, nor yet near to each other, without some catastrophe. Also in very stormy weather the rudder is not the best invention that can be had, as in the case of the foundering, with all hands, of the *Captain* a few years since. It is an opinion amongst some naval officers of high standing that the *Captain* was short of steam, which was the reason she would not luff to the wind, and her loss might have been prevented had she done so. But my idea has always been in that case that the rudder in so heavy an ironclad (or in any other) would be next to useless in stormy weather, and I still maintain it, that the *Captain* might have been saved had she been fitted with a much quicker steering machinery. Another instance is that of the *Agincourt*, which drifted on to the rocks sideways, partly through not having a proper steering machine and partly from want of sufficient steam. There is also the ironclad *Lord Clyde*. The following is a telegram from the *Times* correspondent at Malta, dated March 18th, 1872:—

"The *Lord Clyde* is now got off again, and is taken in tow of the *Lord Warden*, but the rudder and rudder post were both gone, and her machinery disabled as well."

Here we have another proof that the rudder might be superseded by a more suitable invention. There is another ironclad, the *Royal Alfred*, which struck against the rocks, her rudder being unable to steer her clear of them. It was reported that the above-named disasters occurred through their not having sufficient steam up in the boilers; that might have been the case sometimes. But the First Lord of the Admiralty said in the House of Commons that generally the ships had plenty of steam at the time of the disasters. One thing appears to me very certain, that a quickly-acting steering-propelling apparatus would have manœuvred the ironclads quite clear of the rocks, with a much less pressure of steam than the common rudder could do at any time, and also a saving of fuel would be effected by using the above invention. An accident has lately happened to the *Defence* which might have been prevented had she been fitted with a steerer-propeller. This vessel scraped the rocks off Pontallaria. The *Aurora* and the *Megæra* met with a disaster also, so well known and often mentioned in the daily papers of late. At the time of the *Captain*'s loss I had a decided opinion that the rudder and screw would be very unsafe in warfare. I also thought that large and heavy ironclads could not be properly steered by the rudder now in use in narrow channels and other dangerous places, or near rocks; and particularly so in very windy weather. I felt sure that sad disasters would sooner or later occur should the old rudder system not be replaced by some better invention, and I think my opinion will be allowed to have been proved so far correct. We read of the captains and other officers of the said ships being tried by courts-martial, and some being dismissed from the navy. But it really seems more likely that the fault is in the rudder not being able to move the iron ships about quickly enough, thereby striking them against rocks and grounding them, etc. Whereas if those in authority at the Admiralty were to have the whole of Her Majesty's ironclads supplied with a safe and quickly-acting steerer-propeller apparatus, we should hear of fewer [illegible] happening in the navy than have [illegible] so much sorrow and pecuniary loss.

IN A QUICKSILVER MINE.

"Grace Greenwood," who has been for some time travelling in the West of America, sends to the *New York Times* an account of a recent visit to a quicksilver mine:—"It was a brilliant May morning when we set out from San José for the new Almaden Quicksilver Mine, some twelve miles away, in the Santa Cruz range of mountains, and on the Alamitos Creek. This quicksilver mine, the largest and richest in the world, with the exception of the old Almaden in Spain, was first known to white men as long ago as 1824, worked a while for silver, and then for a long time abandoned. It is the most uncertain sort of mining, there being nothing like a regular vein of ore to follow, but only in many places very slight threads connecting the 'ore-spots,' while some of the deposits are isolated, lying hidden slyly away in Nature's most secret drawers and dark pockets. The process of reducing the ore, of rousing the latent mercury from its sleep of a million or so of years, is very interesting and easy of comprehension, even to a woman, when patiently and pleasantly explained, as it was to us. It is simply burnt out of house and home, or its dull old body perishes by cremation, that it may appear in a glorified form, to shine and serve in a thousand beautiful ways. It is compelled to awake and come forth, or, as an old miner said, to 'get up and git,' by intense and long-continued heat. The ore is put into furnaces, each holding 15,000 pounds, and having in one end the fire, which is kept up for about three days. The vapours from the heated ores pass from the furnaces through small apertures, like pigeon-holes, into condensing chambers, on the cool walls of which the globules of mercury form and glide at once to the floor, where they collect in little gutters and flow out into troughs, which convey them to an iron cauldron, from which they are transferred to the wrought iron flasks in which they are sent to market. Each flask contains 76½ lbs., the equivalent of 75 lbs. Spanish measure, and is worth 40 dols. It was strange to see this fluid treasure come flowing and flashing down like a mountain stream, to see it dipped up like so much spring water. The unstable, illusive character of this costly product is not understood by all visitors. Young and curious tourists have been known to attempt to carry away a thimbleful or so in their pockets, and have confessed to having at once experienced a singular trickling, trickling sensation, usually passing like a streak of cold lightning down the right leg and into the boot. One elderly gentleman, by profession clerical, but by temperament mercurial, once succeeded in secreting a portion of quicksilver in his spectacle-case, which he carried in the same breast-pocket with his watch. His little theft was not discovered at the time, but the next morning he indignantly proclaimed that he had been robbed. His valuable gold repeater had been taken from his pocket, and a silver watch put in its place. The contents of the spectacle-case had also mysteriously disappeared. Quicksilver in the mass has such a molten look that you shrink from touching it; but it is exceedingly cold. It gives you a strange sensation to plunge your hand into the solid, fluid, heavy, buoyant substance, which has the very chill of death, yet is alive in every infinitesimal globule. There seemed to be something unsubstantial about it after all. I could clutch it, but not hold it. It was like palpable moonshine. I dipped my hand in up to the wrist, and not a particle adhered to my fingers. Silver never would stay by me. The manager first showed us the reduction-works, of which I have tried to give some slight idea. I was surprised at the number of chambers necessary for the thorough condensation of the vapour. It sometimes passes through ten or eleven before all the quicksilver is precipitated. The uncondensed deleterious portions are carried off by means of flues into an immense high chimney, which lets them off when they [illegible] do harm to man or beast. The stories of miners and mules 'perishing slowly' of mercurial poison; of unhappy smelters 'working out their own salvation with fear and trembling,' are no longer to be credited. From the works we drove up the mountain to the new tunnel, which is the one most worked at this time. It is several hundred feet below the old workings, is about 2500 ft. in length, 10 ft. wide, and well timbered where it is not cut through the hardest kind of rock. Into this grand tunnel our party was taken in grand style. We rode in ore-cars, on blocks of wood, which made the most reliable sort of seats. We were drawn by a stout and serious-minded mule, and each fellow of us carried a lighted candle stuck in a split stick. Thus we plunged into the darkness and the silence of inner earth, and woke the sullen echoes with laughter and merry shouts, and called out with our flicking torches momentary gleams from crystals imprisoned in the dull rocks for ages dreaming of the light. Looking back from the first car in the procession it had a strange, wild look, and we all had a sense of something adventurous and mysterious, and delightfully awful and Arabian Nightish, about the expedition. We should hardly have been surprised to come upon the cave of the 'Forty Thieves,' with all their treasures in it—or, when we turned back to the day, to have found the door of the tunnel closed against us. When about 1800 ft. in we left our cars and walked the rest of the way—and a wild, rough, pitfallish way it was—to drifts where the men are now working at the new discoveries. The ore is very fine, and apparently abundant, the cinnabar showing in wide, long deposits the rich, red arteries of the heart of the old mountain. The air in the tunnels and drifts we found not impure, damp, or oppressive, yet we were quite willing to return to outside wind and warmth and sunlight, and drive down to the picturesque country-house built by General Halleck when he was manager of the mine, and then our friend and host proceeded to crown the courtesy which had made for us a day of unequalled enjoyment by having attached to his carriage four fresh, spirited, handsome horses, and so, in such state, he drove us back to our hotel at San José, through the splendours of sunset and the freshness of evening airs. Could anything have been finer or jollier, more nobby or nab bby, than this?"
—*From the "Times."*

SAWING WOOD WITHOUT A SAW.

Electricity is, by the present invention, made to supersede a time-honoured mechanical implement, threatens also to drive it into banishment, while the muscular and other forces which were so largely expended in their use are replaced by the action of the galvanic battery in one of its most simple forms.

The invention we are about to describe, and which was patented in the United States on the 28th of last May, is that of George Robinson, M.D., of New York.

That gentleman was well aware that a galvanic current in sufficient quantity, when passed over fine platinum wire, would raise its temperature to a red or even white heat. The most important application of the principle had previously laid in the employment of the heated wire in certain surgical operations as a substitute for the knife or red-hot iron. It was found that the red hot wire easily cut or rather burnt its way through the living flesh, and tumours of considerable size were thus removed from the human body. The inventor's attention being fixed on the fact that sodden, wet flesh was cut through in this way, a little reflection satisfied him that the division of wood, a comparatively dry substance even when green, could be more readily effected by the electrically heated wire. This proved to be the case, and on gently pressing pieces of wood against the red hot platinum wire, especially when aided by a slight sawing movement, the wood was divided in any required direction, as by a handsaw, and, of course, without any effort of skill or appreciable expenditure of muscular power. By [illegible]

the wire with handles or other means, so as to guide it readily, the lumber, whether in trees, logs, or planks, may be cut easily as desired. There is here, therefore, a simple and easily applied force, which in a child's hands may be employed to fell trees, divide them into logs, and, in short, perform all the operations of the saw and the axe. The surface of the wood where thus divided is, of course, slightly charred, but the black layer is very thin, and for many purposes not disadvantageous, as it is known to preserve timber. The battery employed need only be of the simplest character, as quantity and not intensity of currents is required.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

The Council of the Institution of Civil Engineers have just awarded the following Premiums for papers read at the meetings during the session 1871-72 —

1. A Telford Medal and a Telford Premium, in books, to Bradford Leslie, M. Inst. C.E., for [illegible] Account of the Bridge [illegible] the [illegible] River on the [illegible] Extension of the [illegible] Bengal Railway [illegible] A Telford Medal [illegible] Telford Premium, in books, to Carl [illegible] M. Inst. C.E., for his paper on [illegible] the [illegible] Medal and a Telford [illegible] M. Inst. C.E., for [illegible] of Egyd Avenue, [illegible] Structure [illegible] Telford [illegible] [illegible] The [illegible] Irrigation [illegible] A Telford Medal [illegible] books, to George [illegible] paper on "The [illegible] Storage and Distri[illegible] A Telford [illegible] Frederick Augustus [illegible] paper on "Explosive [illegible] Purposes." 7. [illegible] books, to Bashley [illegible] the Construction [illegible] to Economy [illegible] engaged." 8. The [illegible] books, to Charles An[illegible] for his paper on "The [illegible] at Malta."

[illegible] have likewise awarded the following [illegible] to students of the Institution:— [illegible] Miller Prize to Oswald Brown, Stud. [illegible] E., for his paper on "Sewage Utilisa[illegible]." 2. A Miller Prize to Arthur Turnour [illegible]son, B.A., Stud. Inst. C.E., for his paper on "Railway Bridges of Great Span." 3. A Miller Prize to John Addy, Stud. Inst. C.E., for his paper on "The most suitable Materials for and the best mode of Formation of, the Surfaces of the Streets of large Towns." 4. A Miller Prize to Alfred Edward Preston, Stud. Inst. C.E., for his paper on "Wood-working Machinery." 5. A Miller Prize to William Patterson Orchard, B.E., Stud. Inst. C.E., for his paper on "The Education of a Civil Engineer."

On the 1st of July there were on the books of the Institution of Civil Engineers the names of 16 honorary members, 756 members, 1127 associates, and 243 students, making in the aggregate 2142. On the 1st of April last these numbers were 14, 745, 1091, and 235 respectively, thus showing an increase in the several classes of 2, 11, 36, and 9, or a total of 58.

ROYAL GEOGRAPHICAL SOCIETY.

At the last ordinary meeting of the session of this society the President, Sir Henry Rawlinson, in the chair, the paper of the evening was "Central Asia in 1872," by Mr. R. B. Shaw, the enterprising traveller who was the first Englishman in modern times to face the dangers of a journey in Eastern Turkistan, and visit the new ruler at Kashgar, in the [illegible] of 1868-9. Mr. Shaw made a second journey as far as Yarkand in 1870, this time in an official capacity as a member of Mr. Forsyth's mission to the Atalik Ghazi, or Sultan of those fertile provinces recently detached from the Chinese Empire. In his paper Mr. Shaw gave a brief but graphic outline of the physical configuration of the country, followed by a description of its present political condition and relations with the British and Russian Empires. The country formed a vast basin or depression in the mountainous centre of Asia, elevated from 3000 to 5000 feet above the sea level, and surrounded on the south, west, and north by ranges of the loftiest mountains in the world, the peaks of which rose to beyond 20,000 feet, and the passes over which were seldom lower than 17,000 feet high. He showed the error of Humboldt's conception of these mountain systems—viz., that they formed on the south two ranges (Kuen lun and Himalaya), and on the north one (Thian Shan), lying in an easterly and westerly direction, with another range (the Bolor) lying north and south, and connecting the Thian Shan with the Himalaya. Recent surveys had shown that the so-called Bolor was only the continuation of the great Himalaya system, which thus formed a broad belt of lofty land, lying nearly N. W. and S.E., and extending from the extremity of Assam to the upper course of the Jaxartes, and that the Kuen lun was not a distinct range. The Atalik Ghazi in 1870 was engaged in a war with the Tunganis beyond the north-eastern extremity of his dominions, the result of which was the conquest of the town of Turfan. But he was recalled from his expedition by a movement of Russian troops, and Mr. Shaw remarked that a depression in the height of the Thian Shan towards the east opens a ready passage from the Russian provinces into Eastern Turkistan. Mr. Shaw stated that our friendly relations still continued, and that other opportunities would soon arise for further exploration of this region.

The President stated that if despatches from Dr. Livingstone arrived, as was expected, in the course of a few days, a special meeting would be called to have them read, due notice of which would be given by advertisement in the daily papers. A vote of thanks to the Chancellor and Senate of the University of London for the use of their hall during the past session was responded to with great warmth and unanimity by the meeting. The following new Fellows were elected:—William C. Barber, R. Blakemore, Samuel Booker, J. G. T. Forbes, staff-surgeon R.N., John Fowler, C.E., W. W. Hunter, LL.D., W. R. Jolly, M.A., Captain William Man, and Charles Norris.

VICTORIA INSTITUTE.

This Society recently held its seventh annual meeting under the presidency of the Earl of Shaftesbury. The Society was founded in 1865 to investigate fully and impartially the most important questions of philosophy and science, and specially any that bear upon the truths revealed in Holy Scripture, with respect to such the Institute holds that "it is impossible for the bulk of our population, whose lives are spent in earning their daily bread, to weigh the evidence of what are stated to be the conclusions of science. They take them on trust if they attend to them at all; and if scientific conjectures are represented to them as the conclusions of science, they are predisposed to accept them as such from the general knowledge they possess of the great things that science has done. It is quite possible that a stumbling-block may thus be placed in the way of religious belief; for though our fundamental idea of the unity of truth involves, as an axiom, the absence of antagonism between real science and revelation, we have no such guarantee respecting scientific conjecture."

Amongst those present were the Archbishop of York, the Earl of Harrowby, Bishop Claughton, Sir D. McLeod, G.C.S.I., Mr. W. T. Marsh, Bart., the Hon. E. Ashley, J. Bateman, F.R.S., Admiral Halstead, &c.

Letters of apology for not being able to attend were received from the Archbishop of Canterbury, Lord Hatherley, the Bishops of London, Chester, and Gloucester, several peers, and others.

Captain F. Petrie read the report, which called attention to the propriety of raising the number of members, so that the Institute's sphere of action might be extended. The report showed a marked progress, a hundred and forty-five additional members and associates having joined during a little more than twelve months, and only two retirements having taken place since the year 1870. All the subscriptions for the year 1871 had been paid with one exception, and the Society had entered upon the year 1872 free from all debt and liability. There had been twelve fully-attended meetings during the year, and the outside demand for the Institute's publications had doubled. The balance-sheet contained, amongst other items, the sum of £29 18s. on account of salaries during the year.

The report was accepted, and votes of thanks to the Council preceded Professor Kirk's address "On the Origin of the Moral Sense"; after which a vote of thanks to the Professor and the President concluded the proceedings. The resolutions were spoken to by the Earl of Harrowby, Sir Donald McLeod, Rev. J. G. Wood, Mr. C. Brooke, F.R.S., Mr. Alexander McArthur, the Rev. Stevenson Blackwood, D.D., Rev. J. Hill, D.D., and others.

THE BRITISH ARCHÆOLOGICAL ASSOCIATION.

This association have issued their prospectus, and from it we gather that the proceedings will be of more than usual attractiveness and enjoyment. On Monday, the 5th day of August, there will be a reception by the mayor and corporation of Wolverhampton, and address of the president, at two p.m., at the town hall, visit to the Collegiate Church and Danish Cross, and Tettenhall Church, inaugural dinner at 6.30 p.m., at the Swan Hotel, the head-quarters of the association. On Tuesday, excursion to Wall; the Letocetum of the Romans, Elford Church, Low Hill, Haselour Hall, and Lichfield and its Cathedral, by permission of the Dean. On Wednesday, excursion to Longbirch; Giffard's Cross, Brewood Church, Blackladies; Boscobel, where Mr. Harrison Ainsworth will read a paper; and Whiteladies, reception by the president, examination of Encampment at Chesterton and Pattingham Church. On Thursday, excursion to Ludstone Hill; Claverley and Quatford Churches, Bridgnorth Castle ruins; Bishop Percy's house, the Hermitage, Worfield Churches, Morville and Aston Eyre Churches. On Friday, an excursion to Uttoxeter, Croxden Abbey, Checkley Church; Roman Station at Rocester, Stafford; St. Mary's and St. Chad's Churches, Castle and Bury Ring. On Saturday, an excursion to Dudley, examination of the Castle and Priory, under the guidance of E. Roberts, Esq., F.S.A.; Kinver Church and Kinver Edge, visit to Enville, by the invitation of the Earl of Stamford, and Hoarton Castle. Evening meetings each day (except Monday) at 8.30 p.m., at the town hall, Wolverhampton, for the reading of papers and discussions. An additional excursion is suggested for Monday, August 12th, by permission of J. Milnes Gaskell, Esq., to Wenlock Priory; and to Buildwas Abbey, by permission of Mrs. Moseley. The papers and addresses will be given, according to circumstances, either at the evening meetings or at the places to which they refer.

HEWETT'S EXHAUSTOR COWL.

Of all the difficulties and annoyances which both builders of houses and the inhabiters of them have to contend with perhaps none equal the nuisance of a smoking chimney; and of the hundreds of inventions which have been made with a view to remedy this evil

not one, up to the present time, has been pronounced infallible in its effects.

The problem to be solved is how most completely to induct from a shaft or chimney one light ascending vapour (smoke or otherwise) into a much heavier body, travelling horizontally, or at right angles to the light ascending vapour.

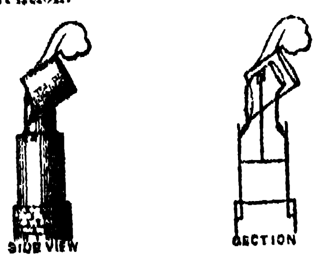
The exhaustor cowl is constructed on the principle of *making the wind do its own work* in this matter.

This is accomplished by placing one tube inside another, the outer and longer one being a passage for the wind, the inner one for the smoke (or vapour), and diverting the path of both wind and smoke into *an identical direction*.

The wind by creating a partial vacuum at the mouth of the inner tube exhausts the air, produces an up-draught, and prevents eddies and curls of wind entering the chimney. These latter cause what by builders is termed the "downflop."

The upper portion of the cowl turning on a spindle always presents, by means of the vane, the proper face to the wind.

A reference to the accompanying illustrations will explain at a glance the action of this invention.



In malthouses and hop-oasts it has long been felt that a more powerful cowl is required for the purpose of speedily and completely getting rid of the vapours which hang over the malt or the hops in the kiln during the process of drying. To effect this object the exhaustor cowl is well designed, as from the principle of its construction it has a strong lifting power.

The patentee is Mr Hewett, of St Leonards-on-Sea; and Messrs. Treggon and Co., of Jewin Street, London, and Messrs. Ash and Lacy, Meriden Street, Birmingham, are agents for the invention.

DEAR COAL.

Marine Propulsion.—An invention of a new propeller has lately been completed, and promises great results both as to economy and speed. Whilst yet imperfect its economy on a boat 90 feet long by 18 feet beam was so great that a thoroughly practical engineer said that when perfected it would give the ordinary speed of the boat with half her coal, and the promised results of the completed invention are still more favourable. There were, however, great, very great difficulties about the matter which have only recently been overcome and made the subject of a new patent. A launch is in the course of building, and we hope in our next to be able to give a good account of her doings.

The Inventors' Patent-right Association, Limited.—This now well-known and ably conducted Association, the prospectus of which appears in the advertising columns, is, as may be seen from the list of recorded specifications, transacting a large patent business. Its organisation for obtaining patents combines so great economy in the charges with sterling efficiency, and its arrangements are so complete for unravelling disputed questions of patent-right, that it is gratifying to find former predictions as to its success fully borne out by the results. Members of the Inventors' Institute, to whom, moreover, it affords special advantages for obtaining and maintaining [illegible] largely avail themselves of the

Progress of Aristocraticism amongst American Inventors.—In our list of patents—Application No. 1957—the full official statement of the record of the application contains the intimation that the invention is a communication from Minnie Hayword Glassie, *gentlewoman*, Joseph Cleghorn Nash, *clerk* (if used in the English legal sense, *clergyman*), and George Augustus Armes, *gentleman*, all of Washington, district of Columbia, United States of America.

APPLICATIONS FOR LETTERS PATENT.

(*Continued from page* 114.)

ends, and cartridge for the same.—1826. J. H Johnson Reaping and mowing machines (com.)—1827. W. R. Lake. Harvesting machines (com.)—1828. W. R Lake. Harvesting machines (com.)

On 18th June.—1829. H Fereday Apparatus in tin and other metals for "sifting" or separation of seeds, coal cinders, and other articles, and divers small substances.—1830. R Boyd Improvements in projectiles and in the manufacture thereof (com.) (Complete Specification.)—1831 R. F. Lewis Pen, pencil, and crochet-needle holders, bouquet holders or flower tubes, needle cases, and other like articles 1832 W. S Taylor Propulsion and construction of tramway engines and carriages, and in the apparatus or mechanism connected therewith, which improvements are also applicable to motive power road engines and carriages.—1833. S Lewin Ploughs.—1834 A. M. Clark Railway carriage brakes (com.)—1835 R A. Gooding. Apparatus for measuring liquids 1836. T. Lambert and E. J. White Self-closing valves or cocks for drawing off water. 1837 T. Hampton Manufacture of Bessemer steel ingots (Complete Specification.)—1838. G L. Turney Boxes to hold pins, hooks and eyes, pens, and other small articles—1839 E Unwin and G. Ovens Apparatus for the delivery of sheets from printing machines, paper-making machines, and other machines which deliver paper or other material in the form of sheets.—1840 R Kuhn Means and apparatus for facilitating the repairing and paving of roads and other places, the apparatus being also applicable for preparing and dressing stone slabs and blocks

On 19th June.—1841 J Cross Rubbers used for washing or cleansing clothes and other articles—1842 A. C Henderson Construction of stereoscopes (com.)—1843. G. C Ogle. Mowing and reaping machines, and in the machinery or apparatus employed therein.—1844. G Le Monnier and J Cochet System of publicity.—1845. W. Bull. Making salt from brine. 1846 W. B Burrow and J. S. Burrow Improved "bin" or receptacle for wine or other bottles.—1847 W. R. Lake. Manufacture of copper covered and copper-cored wire (com.)—1848 T. Morris, T Fletcher, M Kelly, and C Fletcher Spring mattresses and other articles for sitting and reclining upon.—1849 J Imray Apparatus for working brakes in railway trains and tramway cars (com.)—1850. J. Millward Musical instruments (com.)—1851. V. van Baerle Manufacture of soap or compositions for washing purposes.—1852. W. Spence. Apparatus for currying leather (com.)—1853 E. Abate Preserving food or organic substances, and also in the machinery or apparatus employed therein, parts of which machinery or apparatus are applicable for making ice and for refrigerating purposes.—1854 A M Clark Camp kettle or culinary apparatus (com.)

On 20th June.—1855 H. E Phillipson. Fulling. 1856. G. Lowry. Construction of radial and other drilling machines and tools.—1857. W. Dawes. Locomotive steam-engines, parts of which improvements are also applicable to other engines.—1858. W. D. Brown. Reaping machines.—1859. W. M. Brown. Machines for pricking and trimming the edges of heels of boots and shoes (com.)—1860. W. Scantlebury Means or apparatus employed for raising and lowering window and other blinds and shutters.—1861. T. Lynch. New or improved system for preventing collisions on railways, and in machinery or apparatus therefor. (Complete Specification.)—1862. W. B. Chapin. Improved contrivance for securing door-knobs and other knobs or handles upon their spindles. —1863. E. Housman. Heating and ventilating churches, hot-houses, and other buildings

for those purposes.—1864. W. E. Newton Stench traps, and in apparatus for making the same, and other curved or partly curved articles.

On 21st June.—1865. W. E. Koche. Piers, jettys, and landing stages, and means for effecting the transference of railway trains to and from ferry-boats and floating vessels, and for staying the said trains when on board such boats or vessels.—1866. Hon. J. T. Fitzmaurice. Apparatus for lowering boats.—1867. W. Robertson, J. G. Orchar, M. A. Muir, and J. McIlwham. Apparatus for winding yarn or thread.—1868. G. Maxwell. Machinery or apparatus used for making bricks and tiles.—1869 T. Davis. Furnaces for heating metals. —1870. J. Calvert. Lamp for moulders or artisans.—1871. I. Fenno and P. Howe. Machines for cutting cloth and other textile or fibrous material. (Complete Specification.)—1872. S. T. Waite, J. J. White, and J. O. Wise. Lighting of fires.—1873. G. T. Bousfield. Rotary ploughs (com.)—1874. J. G. Horsey. Manufacture of brushes and brooms, and in the machinery or apparatus employed therein. (Complete Specification.)—1875. E. Turner. Door springs.—1876. S. B. Smith and J. W. Willans. Process of and apparatus for smelting iron ores and other ores, and reheating iron and other metals, parts of which improvements may also be applied to other purposes.—1877. G Burge. Kilns for burning cement, lime, and other substances.—1878. J. Touros. Obtaining colouring matters derivable from madder, munjeet, and other allied roots. 1879. W Birch. Mode of and apparatus for treating horny and other analagous animal substances for the purpose of converting them into an elastic substance to be used in place of whalebone, bristles, and for other purposes for which such elastic substance may be applicable.

On 22nd June.—1880. W M. Brown. Apparatus for extracting ammonia in the form of liquid ammonia from crude ammoniacal liquors (com.)—1881 E. Milner. Producing white pigments from lead.—1882. B. Wrigley. Kilns for burning bricks, pottery, and lime.—1883 J Campbell Decreasing the rolling of vessels. 1884. J. Arthur. Screw bolts and nuts.—1885. J. Horsley. Manufacture of an explosive compound, and a new mode of firing explosive compounds.—1886. J. Thomas. Furnaces for generating gas and melting metals.—1887. J. Kirby. Machinery or apparatus to be used in frames for winding linen or other yarns.—1888. J. Tabor Tell-tale for registering the number of packages taken to or from vessels, vehicles, warehouses, and other places.—1889. W. R Lake. Check tickets and methods of forming packages of the same, chiefly designed for use on railways and steam-boats (com.)—1890. L. Dow Newell. Ships' berths and sofas.—1891 B. Burleigh. Lever apparatus for railway switches.—1892. G. A. Dorsett. Obtaining anthracine from heavy oils and in apparatus employed therein.—1893. W. Beale. Apparatus for turning over the leaves of music.—1894. T. Redmayne. Desks, seats, and music stands, applicable to the use of schools and other purposes.—1895. J. F. Swinburn. Breech-loading small arms.—1896. G. Davidson. Machinery for washing fibrous pulp or material for the manufacture of paper.

On 24th June.—1897. H. P. F. Palmer. Cases or crates for containing roofing slates while in transit, and other articles requiring packing cases to preserve them from injury.—1898. T. Atkins. Pumps, parts of which improvements are also applicable to other purposes.—1899. P E. Chappius. Manufacture and application of reflecting surfaces for the better reflection and diffusion of light.—1900. J. Sagar. Machinery or apparatus for raising and forcing water or other fluids.—1901. E. Salt. Rag engines, washing engines or beaters employed in the production of pulp or paper "stuff."—1902. E. P. H. Vaughan, F.C.S. Furnaces, stoves, and other apparatus for consuming fuel (com.)—1903. B. Hunt. Apparatus for shearing or clipping sheep, horses, and other animals (com.) (Complete Specification.)—1904. A. Taylor. Apparatus used for bleaching yarns and cloth.—1905. W. E. Newton. Manufacture of vinegar and in the acidulation or treatment of various liquids, and in the apparatus employed therein (com.)—1906. W. Phillips. Pea stage adapted for supporting and protecting peas during their growth, for protecting half-hardy plants, and as a forcing frame.—1907. J. Richetts and A. Leibschmidt. [illegible] postage stamps.—1908. J. Wands and E. Wands. Apparatus employed in [illegible]

wire.—1909. M. Burke. Screw propellers.—1910. J. Hartley and E. Sugden. Boilers for heating of water for warming buildings and other like uses.—1911. J. L. Norton and J. H. Carter. Decorticating, hulling, or polishing wheat and other grain or seed, and in dressing bran, and in apparatus employed for such purposes.—1912. W. Young. Printing, and production of printing surfaces, also apparatus to be used for these purposes.—1913. A. M. Clark. Distress rudder and drag for vessels (com.)

On 25th June.—1914. J. Townsend. Furnaces or apparatus for obtaining heat or gases from coal or other substances containing carbon.—1915. W. Harris. Lenses and lamps wherewith such are or may be used.—1916. W. Mansone and W. McKenzie. Production of stereotype plates, and in apparatus employed therefor.—1917. S. J. Wallis. Discharging both locks or barrels of a double-barrelled gun by one trigger. (Complete Specification.)—1918. W. Simons and P. P. White. Steam pile-driving apparatus.—1919. C. W. Siemens. Obtaining and applying magneto-electric currents, and apparatus therefor (com.)—1920. C. Caselton and H. Toogood. Saw frames or machinery for cutting tile, slate, and other laths, boards, deals, battens, and other woods and materials usually cut by saws.—1921. J. Merrylees. Weaving ornamental fabrics, and in apparatus therefor.—1922. T. Gibson. Machine for cutting lump sugar.—1923. J. E. T. Woods and J. Clark. Improved alloy for anti-acid metal and for other purposes.—1924. E. G. Brewer. Modes of and in the means or apparatus for operating the rotating parts of sewing machines, and of other analogous machinery (com.)—1925. R. E. Middleton. Machinery or apparatus for breaking stones, ores, and other like substances.

On 26th June.—1926. R. G. How. Mechanism for indicating and recording the speed of railway trains.—1927. W. Corney and S. S. Turner. Stop motion for looms. (Complete Specification.)—1928. P. Poggi. Mechanical combination, constituting improved motive-power machinery adapted for industrial and other purposes (com.)—1929. R. W. Simpson, R. Hopps, and D. Johnson. Scribbling wool and other fibrous substances.—1930. O. McC. Chamberlain. Sewing machines for folding plaits.—1931. J. S. Christopher and J. F. Lackersteen. Manufacture of hydrogen gas.—1932. B. F. Stevens. Apparatus for raising, lowering, and securing ships' boats (com.)—1933. G. Whitaker and J. Ashworth. Preparing wool or other animal fibre for carding or combing.—1934. A. M. Clark. Apparatus for feeding and drying whitelead and other pulpy or semi fluid substances, and for feeding oily and pasty substances (com.)—1935. R. A. Parkis. Mode of and apparatus for refrigerating liquids.—1936. W. H. Denham, P. V. Denham, and A. A. Denham. Waterclosets and apparatus connected therewith, parts of which improvements are applicable to other purposes.—1937. W. R. Lake. Gathering, ruffling, or plaiting apparatus for sewing machines (com.)

On 27th June.—1938. A. Hookham. Money tills. (Complete Specification.)—1939. M. Paul and J. Haythorn. Steering apparatus.—1940. W. Wright. Taps and apparatus for flushing waterclosets, and in taps for other purposes.—1941. J. R. Cazier. Application of safety valves to steam boilers. (Complete Specification.)—1942. J. W. Ward and J. C. Rouse. Jacquard machinery or apparatus.—1943. J. S. Cooke. Machinery or apparatus to be employed in dyeing wool, silk, cotton, flax, or other fibrous substances in the hank or skein.—1944. J. H. Johnson. Sifting or bolting machines (com.)—1945. J. Millward. Hydrants for supplying fire-engines from street mains (com.)—1946. J. G. Tongue. Manufacture of artificial flowers, foliage, fruit, and other similar objects or ornaments (com.)—1947. W. M. Parker and J. R. Robson. Steam and other motive-power engines and pumps.—1948. F. J. Chesebrough. Manufacturing oil and oil cake from seeds, and in the machinery to be used therein (com.)—1949. J. Fletcher. Machinery for forging and rivetting.—1950. G. Yule. Cylindrical and other rulers for office and general use.

On 29th June.—1951. H. Johnson. Preserving butter and other fatty matters, and in the apparatus or means employed therein. (Complete Specification.)—1952. A. C. Kirk. [illegible] apparatus, and in motive-power apparatus for [illegible] the same, or for working winding, hoisting, or other apparatus at a distance.—1953. H. Giroud. New and improved system of rheometric regulator used with a gas-burner only.—1954. S. Chatwood and J. H. Collins. Separating or dressing tin and other ores.—1955. T. S. Derham and C. W. Thirlwall. Machinery for manufacturing bricks.—1956. T. H. Phillips. Apparatus or appliances applicable for heating, cooking, and lighting purposes.—1957. W. R. Lake. Fastenings for uniting and securing the parts of bedsteads, and for other like purposes (com.) (Complete Specification.)—1958. R. T. Gillibrand and J. Walmsley. "Looming" or piecing yarn for weaving.—1959. H. Rawson. Looms for weaving.

On 29th June.—1960. W. R. Harris and J. Holding. Healds employed in looms for weaving.—1961. R. Jobson. Manufacture of supports for telegraph insulators.—1962. J. S. Crosland. Stationary and marine boilers or steam generators, and in feed-water heaters or economisers.—1963. E. de Zuccato. Producing copies of writings, figures, drawings, or delineations.—1964. B. Rose. Manufacture of gas and in the treatment of the residues therefrom, in the means of purifying and rectifying the same, and in the combination or amalgamation of gases for the production of light and heat and for other useful purposes, and in the machinery and apparatus to be employed therein.—1965. J. F. Hodges, M.D. Preparation of bankers' cheques and other printed forms.—1966. G. Lowry. Hackling machines. (Complete Specification.)—1967. W. C. Rogers. Apparatus or appliances for regulating the supply or flow of gas to burners.—1968. J. Castle. Revolving and other shutters, and in temporary partitions, particularly applicable for preventing the transmission of sound between two portions of a school, class-room, room, chamber, or other apartment temporarily divided.—1969. E. Edwards. Apparatus for preventing the escape of sparks from smoke stacks or chimneys (com.) (Complete Specification.)—1970. E. P. Spahn. Camera stands. (Complete Specification.)—1971. H. Jewitt. New toy called "mosquerade blocks" (com.)—1972. W. Walton. Improved self-locking burglar-proof sash-keep with ventilation combined.—1973. W. Prosser. Spreading nozzles.—1974. W. Todd. Dyeing, sizing, and dressing yarns.—1975. W. Downing. Floor-cloths, felt, and paper, and in the means of colouring and printing the same or other textile or woven fabrics.

On 1st July.—1976. J. Maddy. Steam engines.—1977. W. M. Brown. Manufacture of Flora shoe nails (com.)—1978. T. White. Means of utilising old and waste leather and other old and waste materials, and materials of small value, as a substitute for new leather in the manufacture of certain portions of boots and shoes and other coverings for the foot or legs, and for other purposes for which leather is usually employed, and in the machinery and apparatus to be used for that purpose.—1979. H. Jollife. Apparatus for refrigerating or keeping cool butter, milk, fruit, and other articles liable to be injured by heat in summer and in hot climates, which apparatus is applicable also for maintaining the heat of cooked food in low temperatures.—1980. M. A. Soul. Machinery or apparatus for boring rocks and such like hard substances (com.)—1981. J. Bowsher. Window-sash fastenings.—1982. W. Robertson. New or improved oscillating engine, suitable either as a steam or other pressure fluid motor, or as a water or other fluid drawing and forcing pump or machine (com.)—1983. W. Matthews. Movable cover or top for show-cases or boxes.—1984. W. F. Gedge. Preparing phosphorus (com.)—1985. W. E. Gedge. Tree-block of shaping apparatus to be used in the manufacture of boots (com.)—1986. A. V. Newton. Tilling implements (com.)—1987. J. Fielding. Apparatus for conveying signals from one person to another in railway trains.—1988. B. W. Wells. Manufacture of floor-cloth.

On 2nd July.—1989. J. Rabone. Spirit levels and plumb spirit levels (com.)—1990. H. J. H. King. Apparatus for obtaining motive power for pumping or for measuring fluids.—1991. W. R. Birkinshaw. Machinery for cutting or bruising coal.—1992. J. Chambell. Sewing machines.—1993. J. Holmes, G. T. Holmes, and F. R. Holmes. Machinery for elevating, raising, and stacking hay, corn, straw, and other substances.—1994. A. Kay. Combined machine of wood and iron for lie-bending, and bevelled swinging drawing-paddle for boats or barges on still water.—1995. E. Davies and S. Dawson. Improved exhaust and blast for millstones.—1996. J. M. B. Baker. Disinfecting and deodorising apparatus for waterclosets and other purposes.—1997. W. E. Newton. Surface-hardening steel (com.)—1998. W. Evans and H. Cochrane. Table knives and forks.—1999. J. Wallace. Gas stoves and burners, and regulating apparatus to be used in connection therewith.—2000. J. Elliott and P. Copley. Machinery or apparatus for cutting or getting coal, stone, and other minerals.—2001. J. L. de Montoison. Means and apparatus for removing the hair or fur from skins, and applying the same to various useful purposes.—2002. J. L. de Montoison. Tanning, and in apparatus connected therewith.—2003. W. Thwaites, E. Fondeville, and G. Bertin. Preparation of glaze or coating suitable for covering stone, earthenware, plaster, furniture, and other surfaces.—2004. W. Thwaites, E. Fondeville, and G. Bertin. Composition or admixture for preserving walls from dampness, and for other purposes.—2005. W. Mitchell. Ladders.

On 3rd July.—2006. G. Noble. Method of treating various kinds of fibrous materials for the manufacture of writing, printing, and other paper.—2007. J. Stones and J. Castle. Revolving and other shutters, and in temporary partitions, parts of which improvements are particularly applicable for preventing the transmission of sound while giving access between portions of a schoolroom, chamber, or other apartment temporarily divided.—2008. E. Le Gros. Drilling machinery (com.)—2009. H. D. Furness. Hydrostatic weighing and lifting machines for adjusting the weight on springs of locomotives, waggons, and carriages, and for other purposes.—2010. J. Vine, sen., J. Vine, jun., J. Brown, and J. A. Skinner. Fire-arms.—2011. E. Newbold. Furnace bars.—2012. P. Newall and J. Barker. Machinery or apparatus for dressing or finishing leather.—2013. R. Turnbull. Means of raising and lowering vessels for repairs, and for other purposes, and in the construction and arrangements of submergible pontoons and apparatus connected therewith.—2014. J. T. Parlour. Apparatus to be used in the formation of asphalt and other pavements. (Complete Specification.)—2015. S. J. Payne. Manufacture of fire-bricks, crucibles, retorts, and other fire-ware goods.

On 4th July.—2016. J. Crop. Tobacco pipes.—2017. W. Gorman. Manufacturing iron and steel, and in apparatus connected therewith, part or parts of such improvements being applicable to various kinds of furnaces, and for the production of gases for heating and illuminating purposes, and for cooking, carbonising, or calcining other substances.—2018. G. Westinghouse, jun. Brake apparatus for railway carriages.—2019. D. Cunningham. Breakwaters, sea walls, and other sub-aqueous works.—2020. J. F. Stewart and H. Defty. Puddling furnaces.—2021. W. McLaren. Sawing or cutting wood.—2022. P. Jensen. Charging furnaces, and in the construction of furnaces and steam boilers (com.)—2023. W. Richter. Machine for breaking bar iron. (Complete Specification.)—2024. A. Sauvee. Distribution for engines multiplying the power of the prime mover (com.)—2025. J. Vavasseur. Breech loading ordnance.—2026. H. Ubry. Locomotive engines.—2027. L. P. Hart. Contrivance for securing false hair on ladies' heads.—2028. W. Smith. Railroads, and in carriages to be used thereon.—2029. B. J. B. Mills. Sizing paper, paper pulp, cotton, linen, and other fabrics and materials, and in materials to be employed therefor (com.)

On 5th July.—2030. Sir J. Bethune. Wheels, especially applicable to traction engines.—2031. T. Clark. Winnowing or seed-dressing machines.—2032. S. Alley. Steam boilers.—2033. J. Miller. Purifying and decolourising hydrocarbons.—2034. R. H. Allen. Construction and general arrangement of ships' passengers' berths for married couples. (Complete Specification.)—2035. B. Todd. Treatment of gases and fumes.—2036. E. J. L. Coillot. Manufacture of lighting and heating gas, and in apparatus and burners connected therewith.—2037. W. Brunskill. Mechanism for forming bungs and similar tapered articles.—2038. J. Simmott and G. Robertson. Machinery or apparatus to be employed for removing motes and burrs from woven fabrics.—2039. E. Umbers and A. G. Fenn. Apparatus for signalling on railways.—2040. T. H. Ward. Pulley

blocks for raising and lowering weights or heavy bodies.—2041. A. M. Clark. Cylinder printing machines (com.)

On 6th July.—2042. D. Peattie. Shades or blinds for windows.—2043. J. Foster, jun. Manufacturing twine and other cord.—2044 W. Weldon. Utilisation of dilute chlorine.—2045. W. W. Tonkin. Means of actuating the valves of engines, pumps, or liquid meters.—2046. E. P. H. Vaughan, F.C.S. Utilising the waste gases of metallurgical and other furnaces (com.)—2047. J. Crofts and R. Dawson. Apparatus employed in combing wool and other fibres.—2048. J. F. Elwell and J. Grove. Safes.—2049. C. F. Schlesinger. Apparatus for beating carpets and other fabrics (com.)—2050. W. R. Lake. Welding brass or other alloy of copper upon iron or steel, applicable to the construction of journal boxes or axle bearings for railway carriages and machinery (com.) (Complete Specification.)—2051. J. Mathews. Jigging machinery for dressing ores (com.)—2052. W. Holbrook. Fasteners for sash and casement windows, shutters, and doors.—2053. W. R. Lake. Ventilating apparatus (com.)

On 8th July.—2054. J. H. Johnson. Cooling air and gases, and in the apparatus or means to be employed therein (com.)—2055. R. E. Donovan. Drill stock.—2056. J. Thomson and J. M. Thomson. New or improved radial drilling machine.—2057. H. R. Marsden. Jaws for stone-breaking machines.—2058. C. D. Abel. Improved portable apparatus for impregnating air with hydrocarbon vapours or volatile oils for lighting and heating purposes (com.)—2059. A. Prince. New or improved boring instrument (com.)—2060. J. Vogan. Raising or elevating corn, grain, or seed from one level to another.—2061. A. B. Barry. Sewing machines.—2062. J. O'Neill. Apparatus for signalling on railway trains.—2063. J. Gomershall and J. F. Gomershall. Manufacture of reversible twill cloth.

On 9th July.—2064. W. Morgan-Brown. Type wheels for printing telegraphs (com.)—2065. W. R. Lake. Improved compound and method of preparing the same, for the construction of street pavements, and for other like purposes (com.) (Complete Specification.)—2066. J. Downes. Locomotive and stationary steam engines.—2067. W. R. Lake. Fire-extinguishing apparatus (com.)—2068. F. G. Marchant. Wheels and apparatus connected therewith, chiefly designed for facilitating the movement of road engines and other heavy vehicles.—2069. J. Cook and H. Lafone. Blow-pipes and means of generating heat by the use of hydrocarbon or other volatile fluid, material, or substance.—2070. P. F. Guerin. Horse shoes.—2071. C. M. Barker. Propelling ships or vessels, and in the propellers to be employed therein.—2072. W. Chisold. Machinery for condensing and drawing fibrous substances.

On 10th July.—2073. W. Morgan-Brown. Printing telegraph instruments (com.)—2074. H. Lancaster. Locks or fastenings, principally intended as a substitute for ordinary padlocks.—2075. W. E. Ellison. Guarding and saving large and small ships from strandings and wrecks, and applicable to any present built ship.—2076. W. B. Adams. Locomotive engines and vehicles for railways, tramways, and common roads, parts of which are applicable to other like purposes.—2077. H. A. Bonneville. Bits (com.) (Complete Specification.)—2078. F. J. Ritchie. Sympathetic clocks.—2079. R. B. Starr. Apparatus to be applied to omnibuses, tramway cars, or similar vehicles, to register the number of passengers carried and the various fares paid during a journey.—2080. G. Webb. Coverings for draught horses.—2081. W. Morgan-Brown. Unison stops for printing-telegraphs (com.)—2082. W. C. S. Percy. Apparatus for protecting outside passengers on omnibuses and other carriages.—2083. H. E. Townsend. Standing rigging of ships and other vessels. (Complete Specification.)—2084. A. M. Clark. Stair and other carpets (com.)—2085. C. A. McEvoy. Circuit closers for torpedoes, and in connecting electric cables and conductors for use with torpedoes and for other purposes.—2086. W. Easton and F. Tattersall. Air-compressing engines.—2087. J. H. Bass. Pots or vessels for making coffee.

On 11th July.—2088. W. Fern. Apparatus for economising fuel and effecting the consumption of smoke.—2089. G. D. Davis and T. Hopcraft. Machinery for working rudders.—2090. J. Chandler. Bath and other apparatus for the control of water and preventing waste thereof.—2091. F. Cole and G. Acton. Apparatus by means of which compressed air may be used instead of steam as a motive power for working engines.—2092. M. A. Muir and J. McIlwham. Appliances in connection with rotating shuttle-boxes or looms.—2093. J. R. Casbay. Compound to be applied to the surfaces of wood or metal to preserve the same from corrosion or decay.—2094. A. F. Lagrange. Typographic presses, also applicable to lithography, autography, and metallography.—2095. S. Holdsworth. Looms for the manufacture of tufted carpets and other tufted pile fabrics.—2096. W. G. Beattie. Axle-boxes.—2097. H. C. Hill. Paving roads, streets, and foot-ways, and in the construction and paving of tram-roads.—2098. W. R. Lake. Shirts (com.) (Complete Specification.)—2099. W. R. Lake. Ties or fastenings for securing bales of cotton and other merchandise (com.)—2100. W. Warnes. Apparatus for stacking or unstacking hay, straw, and other agricultural produce.

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T. F. Heath, junior. Apparatus for compressing materials by means of hydraulic power alone, or in connection with mechanism.

On July 15th. 2126 R J Johnson Improved method of sewer ventilation - 2127 O Hyde Steam traction road waggons, commonly known as road steamers, which may also be used as a steam plough or farm waggon, including improvements in elastic tires or treads for traction wheels, improvements in the steam boilers to be used on said traction engines, also improvements in mounting and operating independently at the rear of said waggon a series of revolving screw-shaped cultivators (Complete Specification) 2128 E Hepple Obtaining motive power. 2129 T Fawcett, and J Coulter. Improved governor for motive power engines - 2130 W R Lake. Improved screw bolt chiefly designed for carriage work (com) 2131 W. R Lake Machinery for manufacturing bolts, rivets, spikes, and other like articles (com)

On July 16th.—2132. D. Cunningham Construction and working of caissons, which improvements are also applicable to movable bridges and the gates of docks and canal locks 2133 H A Bonneville Manufacture of imitations of tapestry (com) 2134 J Ashwell Construction of furnaces, and in the arrangement of flues or passages for economising fuel therein 2135 B Brower Improvement in card holders (Complete Specification)

On July 17th 2136 J. B Robertson Steam traps 2137 J Dale Manufacture of oxylates of soda and potash. 2138 R M M Alloway Improved process for desiccating oak bark, flax, hemp, tobacco plat, mustard, and other substances by atmospheric evaporation 2139 G. Newsome. Machinery for lithographing and letter-press printing 2140. R Blair Axles and axle boxes for carriages and other vehicles 2141 H S Copland Apparatus for mixing precipitating materials with sewage and removing deposits, which apparatus is applicable also for other purposes 2142. J Imray Apparatus for supporting respiration and light in suffocating or explosive atmospheres (com) 2143 L Bradley and J Speight Forming roads and other ways 2144 S S Bateson Treatment of hides or skins 2145 M A Weir Apparatus for registering and checking entries and exits to and from tramway cars, omnibuses, or other carriages - 2146 E Brooks Brooms and brushes 2147 H Sherry Punching and shearing machines 2148. W Jenkins Machinery for rolling leather 2149 J Bidder, A C L Lamb, and W C Scrivener. Clasp or fastener for neck laces and other personal ornaments and wearing apparel 2150 W F Godoe Machine for splitting wood and cutting it into lengths (com)

On July 18th - 2151 C J Nicholl and E Voss Ventilating ships railway carriages, houses, and other buildings 2152 C W Siemens Regenerative gas furnaces for the manufacture of glass (com) 2153 W Paterson, W A Sanderson, R Sanderson, and J Sanderson Treatment of wool in process of manufacture, and in the preparation of materials therefor 2154 C G Hill. Machinery for goffering, fluting, and crimping net and other fabrics - 2155. J. W. Melling Engines actuated by steam or other elastic fluid —2156 F J Cheesbrough Evaporating and concentrating sulphuric and other acids, also salt, sulphur, and other substances capable of evaporation, and in the apparatus to be used therein (com) 2157 G D Hughes Steam-engine or other motive-power governors, and apparatus connected therewith 2158 C de Negri, G Herrmann, and W Guest Machinery for braiding whips or other articles.—2159 J G Smeaton. Generation of steam and the circulation of heated water —2160 W N Hutchinson. Railway engines, carriages, and vehicles, and in permanent way therefor - 2161. D. Tmiriazeff. Machinery for forming stereotype moulds or matrices.—2162 W Lanney. Propelling looms, winding engines, and various other machines.

On July 19th —2163. J. Pullon, sen, and J Pullon, jun Method of casting and making lead D traps.—2164. R. Payne. Indicating the variations of heat in holds of vessels, rooms, or other places at a distance (com) (Complete Specification.)—2165. H. Robinson. Construction of railway waggons -

(Continued on page 140.)

The Scientific Review.

SEPTEMBER 2, 1872.

THE AYRTON AND HOOKER CASE, AND THE RELATIONS OF MINISTERS OF STATE AND MEN OF SCIENCE.

Before the doors of the House of Commons closed for the Session, some statements were made in that assembly by Mr. Ayrton and other members of the Government with reference to the case of Dr Hooker, whereby it was made abundantly manifest that the latter gentleman had been very sensitive in regard to the improprieties of conduct of his official superior, and that Mr. Ayrton had adopted in his dealings with Dr. Hooker a course of action and a mode of speech which no man of any self-respect could for one moment tolerate. Further, that the Premier considered himself bound to uphold his brusque satellite in the eccentric course he had adopted.

It is not our business to enter into questions of good taste and good manners, or to consider whether the calm politeness of the English gentleman [illegible] self-assertion [illegible] rowdy [illegible] suitable to a member of the British Government [illegible] it is within our province to speak [illegible] when [illegible] on the dignity of men of Science.

In this country the position of Science and its votaries is by no means [illegible] to their merits. We have been so much [illegible] Science [illegible] progressing in an almost spontaneous [illegible] flowers [illegible] taking for the love of the thing, that [illegible] we have never given ourselves much trouble about the matter, nor considered it necessary to support and [illegible] the one or the other. If occasionally some job could be perpetrated or some one could be found who was courtier enough to be [illegible] C.B., or knighted and subsidised, the [illegible] considered one for extraordinary laudation of the [illegible] the day.

[illegible] make it a national question which of the two [illegible] be retained as absolutely necessary to the welfare of the country, the politician or the man of Science, the answer of a man of common sense who calmly considered the matter would be that the loss of a thousand politicians would be [illegible] by that of one man of scientific eminence.

What is it that the politician does for us? and what is it that the man of Science (be the abstract or applicative) does for us?

The politician [illegible] involve us in domestic turmoils and foreign disputes [illegible] he simply schemes to keep his party in power, without regard to the great interests which are the very mainstay of our national greatness. If a question of national education be required to be dealt with, it must be warped and dwarfed to suit the distorted views and absurd prejudices of any narrow minded sectarian party that may be powerful for doing mischief to a Ministry the *bona fides* of which is by no means its great tower of strength. If it be a question of assisting the progress of scientific discovery in any way that will incur some comparatively trifling expenditure, then it is at once decided that no such assistance can be given; for thus the Ministry will show itself to be rigidly economical, and may cloak a lavish expenditure on the artificial requirements of officialism and the insatiate demands of a well-organised and insidious system of public jobbery. In truth, if it were not for the knack that Englishmen have of taking matters into own their hands immediately any political crisis becomes imminent, our politicians would ere now have irretrievably ruined the country. In short, it may be confidently asserted that men who become specially politicians are usually rendered far less useful as good citizens than if they had never adopted that speciality.

Men of Science, however, are in a far different position: they add to the stock of human knowledge, to national prosperity, and to domestic comfort. Without our astronomers and mathematicians navigation, which is a mainstay of commerce, would be a mere matter of shore creeping, and many of our great arts and industries would have the stunted proportions of the handicrafts of the olden days.

Without our chemists and electricians we should be unable to carry on many of the everyday operations of the factories and workshops of the present time, and should not possess that rapid circulation of knowledge and intelligence which is such a powerful adjunct to our progression in civilisation.

If we had no natural philosophers, engineers, and mechanicians amongst us, not only should we fall far behind in keeping up our natural defences, but we should soon have nearly all our arts and trades brought to a dead-lock, and our commercial and industrial supremacy would exist only as historical facts.

In fact, the existence and action of such a popular body as the British Association proves the public importance of Science and its professors.

No doubt much that has been achieved as regards material civilisation has been due to inventors rather than to the trained men of Science, but whilst it is true that the latter not unfrequently recruit the ranks of the former, it is also true that the former by their discoveries in Science open up new paths of practical progress to the latter, and they in turn supply the men of Science with new instruments and appliances to aid them in their researches.

In fact, the two are Siamese Twins, and the separation of the one from the other would be attended with fatal effects.

We are free to admit that men of Science and inventors are not generally clerkly men or good accountants, and hence may require to have official men as directors in regard to their business action, but this need not involve treatment which no man of self-respect would tamely submit to. It seems to be the established Governmental practice of this country to cheat and bamboozle scientific men and inventors, we trust the good sense of the British nation will not allow them to be bullied also.

Plaster as a Protection from Fire.—After the conflagration in Paris, it was generally found that, with good plaster work over them beams and columns of wood were entirely protected from the fire. In cases where limestone walls had been utterly ruined on the outside by the flames passing through the window openings, the same walls, internally, escaped almost unscathed, owing to their being coated with plaster. On many such plastered walls the distemper decorations were still to be made out. The iron roofs rendered good service, and the party walls of each house were carried up right through the roof—a most important precaution, for otherwise nothing could have prevented the disastrous conflagration from being more extensive than it was. It was also found that good woodwork in beams and posts, good wood floors, well pugged, and good wooden staircases, were safer and more to be depended upon than cast iron columns and stone staircases, landings, and floors. Stone staircases well protected by plaster were fireproof, although not so safe as wood in case of heavy *débris* falling upon them.

Magnetic sand is found in immense quantities on the sides of the volcano of Mount Ætna. The specific gravity of this sand is 2·813. Acids have little effect upon it. Analysis gives silica 52·71, magnetic oxide of iron 19·44, alumina 19·09, lime 6·01, magnesia 1·85.

The British Association.

On Thursday, August 14th, the members assembled under the dome of the Pavilion, Brighton, when Sir William Thomson, the President of the past year, resigned his seat to Dr. W. B. Carpenter, LL.D., F.R.S., F.L.S., F.G.S., the Registrar of the London University.

The address commenced with a retrospect of Dr. Carpenter's thirty-six years' connection with the Association, dating from its first and only meeting at Bristol. The "fathers and elder brothers" of that day—Whewell and Peacock, James Forbes and Sir William Rowan Hamilton, Buckland and De la Beche—where were they? One of those great men, whose departure had occurred since they last met, claimed special notice. How they should have sympathised with Murchison in the delight with which he would have heard of the safety of the friend in whose scientific labour and personal welfare he felt to the last the keenest interest. That this intelligence should have been brought to them through the generosity of one and the enterprising ability—might he not use the peculiarly English word "pluck"—of another of our American brethren could not but be a matter of national regret. Let them bury that regret in the common joy which both nations feel in the result; and, while giving a cordial welcome to Mr. Stanley, let them glory in the prospect now opening that England and America will co-operate in the glorious object which, far more than the discovery of the sources of the Nile, the great traveller has set before himself as his true mission, the destruction of the slave trade. In reviewing the scientific progress of the past year Dr. Carpenter announced that liberal arrangements had been made by the Government for prosecuting on a more extended scale the inquiry into the physical and biological conditions of the deep sea, on which he, with Professor Wyville Thompson and Mr Gwyn Jeffreys, had been engaged for three years. H.M.S. *Challenger* was being fitted out at Sheerness for a circumnavigating expedition to be organised by a commission on which the Association was represented. Professor Wyville Thompson would take the scientific charge of it, and it was expected to sail in November next. A brief allusion was made to the eclipse expedition sent out to India under Mr. Norman Lockyer, from which it was said that a most valuable body of results had been obtained, and were about to be published, under the direction of the council of the Astronomical Society.

MAN AS THE INTERPRETER OF NATURE.

Previous inaugural discourses, said the President, had generally taken up some aspect of nature in her relation to man. He was not aware that any one of them had turned to the other side of the inquiry—that which concerned man as the interpreter of nature. He thought it, therefore, not inappropriate to consider the mental processes by which are formed those fundamental conceptions of matter and force, of cause and effect, of law and order, which furnish the bases of all scientific reasoning, and constitute the *philosophia prima* of Bacon. They were primarily concerned with the intellectual representation of nature, the two other principal characters in which man acted as her interpreter being those of the artist and the poet. All artists looked at nature with different mental eyes, and to each nature was what they individually saw in her. It was the object of the poet to represent what he felt in nature, and to him nature was what he individually found in her. "There is a class of cases in which certainty is generally claimed for conclusions that seem to flow immediately from observed facts, though really evolved by intellectual processes; the apparent simplicity and directness of those processes either causing them to be entirely overlooked, or veiling the assumptions on which they are based. Thus Mr. Lockyer speaks as confidently of the sun's chromosphere of incandescent hydrogen, and of the local outbursts which cause it to send forth projections tens of thousands of miles high, as if he had been able to capture a flask of this gas, and had generated water by causing it to unite with oxygen. Yet this confidence is entirely based on the assumption that a certain line which is seen in the spectrum of a hydrogen flame means hydrogen also when seen in the spectrum of the sun's chromosphere, and, high as is the probability of that assumption, it cannot be regarded as a demonstrated certainty, since it is by no means inconceivable that the same line might be produced by some other substance at present unknown. And so when Dr. Huggins deduces from the different relative positions of certain lines in the spectra of different stars that these stars are moving *from* or *towards* us in space, his admirable train of reasoning is based on the assumption that those lines have the same meaning—that is, that they represent the same elements—in every luminary. But when Frankland and Lockyer, seeing in the spectrum of the yellow solar prominences a certain bright line not identifiable with that of any known terrestrial flame, attribute this to a hypothetical new substance which they propose to call helium, it is obvious that their assumption rests on a far less secure foundation until it shall have received that verification which, in the case of Mr. Crooke's researches on thallium, was afforded by the actual discovery of the new metal, whose presence had been indicated to him by a line in the spectrum not attributable to any substance then known. And I think it can be shown that the trustworthiness of this common-sense decision arises from its dependence, not on any one set of experiences, but upon our unconscious co-ordination of the whole aggregate of our experiences—not on the conclusiveness of any one train of reasoning, but on the convergence of all our lines of thought towards this one centre." The President then went on to explain the distinctive features of the two schools of thought which attribute our primary beliefs respectively to intuition and experience, and to point out how they might be harmonised by the theory of inheritance, an opinion in which he said Mr Mill to a great extent concurred. Having dealt at some detail with our notions of matter and space as sense-perceptions, the President passed to the consideration of the general conceptions to which experience gives rise—the laws of nature. Dr. Carpenter summed up his argument in the following terms.—Now since it is universally admitted that our notion of the external world would be not only incomplete but erroneous if our visual perceptions were not supplemented by our tactile, so, as it seems to me, our interpretation of the phenomena of the universe must be very inadequate if we do not mentally co-ordinate the idea of force with that of motion, and recognise it as the "efficient cause" of those phenomena—the "material conditions" constituting (to use the old scholastic term) only "their formal cause."

MATTER IN RELATION TO FORCE.

The mechanical philosophy of the present day tends more and more to express itself in terms of motion rather than in terms of force, to become kinetics instead of dynamics. Thus from whatever side we look at this question—whether the common sense of mankind, the logical analysis of the relation between cause and effect, or the study of the working of our own intellects in the interpretation of nature—we seem led to the same conclusion that the notion of force is one of those elementary forms of thought with which we can no more dispense than we can with the notion of space or of succession. And I shall now, in the last place, endeavour to show you that it is the substitution of the dynamical for the mere phenomenal idea which gives their highest value to our conceptions of that order of nature which is worshipped itself as a God by the class of interpreters whose doctrine I call in question.

After some remarks on the value of *common sense* as a basis for scientific theories, Dr. Carpenter referred to—

THE TRUE VALUE OF KEPLER'S LAWS.

The most illustrative as well as the most illustrious example of the difference between the mere generalisation of phenomena and the dynamical conception that applies to them is furnished by the contrast between the so-called laws of planetary motion discovered by the persevering ingenuity of Kepler, and the interpretation of that motion given us by the profound insight of Newton. Kepler's three laws were nothing more than comprehensive statements of certain groups of phenomena determined by observation. The first—that of the revolution of the planets in elliptical orbits—was based on the study of the observed places of Mars alone; it might or might not be true of the other planets, for so far as Kepler knew there was no reason why the orbits of some of them might not be the excentric circles which he had first supposed that of Mars to be. So Kelper's second law of the passage of the radius vector over equal areas in equal times so long as it was simply a generalisation of facts in the case of that one planet carried with it no reason for its applicability to other cases, except that which it might derive from his erroneous conception of a whirling force. And his third law was in like manner simply an expression of a certain harmonic relation which he had discovered between the times and the distances of the planets, having no more rational value than any other of his numerous hypotheses. Now the Newtonian "laws" are often spoken of as if they were merely higher generalisations in which Kepler's are included; to me they seem to possess an altogether different character. For starting with the conception of two forces, one of them tending to produce continuous uniform motion in a straight line, the other tending to produce a uniformly accelerated motion towards a fixed point, Newton's wonderful mastery of geometrical reasoning enabled him to show that, if these dynamical assumptions be granted, Kepler's phenomenal "laws," being necessary consequences of them, must be universally true. And while that demonstration would have been alone sufficient to give him an imperishable renown, it was his still greater glory to divine that the fall of the moon towards the earth—that is, the deflection of her path from a tangential line to an ellipse—is a phenomenon of the same order as the fall of a stone to the ground; and thus to show the applicability to the entire universe, of those simple dynamical conceptions which constitute the basis of the geometry of the principia. Thus, then, whilst no "law" which is simply a generalisation of phenomena can be considered as having any coercive action, we may assign that value to laws which express the universal conditions of the action of a force the existence of which we learn from the testimony of our own consciousness. The assurance we feel that the attraction of gravitation must act under all circumstances according to its one simple law is of a very different order from that which we have in regard (for example) to the laws of chemical attraction, which are as yet only generalisations of phenomena. And yet even in that strong assurance we are required by our examination of the basis on which it rests to admit a reserve of the possibility of something different — a reserve which we may well believe that Newton himself must have entertained. A most valuable lesson as to the allowance we ought always to make for the unknown "possibilities of Nature" is taught us by an exceptional phenomenon so familiar that it does not attract the notice it has a right to claim. Next to the law of the universal attraction of masses of matter there is none that has a wider range than that of the expansion of bodies by heat. Excluding water and one or two other substances, the fact of such expansion might be said to be invariable; and, as regards bodies whose gaseous condition is known, the law of expansion can be stated in a form no less simple and definite than the law of gravitation. Supposing these exceptions, then, to be unknown, the law would be universal in its range. But it comes to be discovered that water, whilst

conforming in its expansion from 39¼ deg. upwards to its boiling point, as also, when it passes into steam, to the special law of expansion of vapours, is exceptional in its expansion also from 39¼ deg. downwards to its freezing point; and of this failure in the universality of the law no *rationale* can be given. Still more strange is it that by dissolving a little salt in water we should remove this exceptional peculiarity, for sea-water continues to contract from 39¼ deg. downwards to its freezing point 12 deg. or 14 deg. lower, just as it does with reduction of temperature at higher ranges. Thus from our study of the mode in which we arrive at those conceptions of the orderly sequence observable in the phenomena of Nature which we call "laws," we are led to the conclusion that they are human conceptions, subject to human fallibility; and that they may or may not express the ideas of the great Author of Nature. To set up these laws as self-acting, and as either excluding or rendering unnecessary the power which alone can give them effect, appears to me as arrogant as it is unphilosophical. To speak of any law as "regulating" or "governing" phenomena is only permissible on the assumption that the law is the expression of the *modus operandi* of a governing power. I was once in a great city which for two days was in the hands of a lawless mob. Magisterial authority was suspended by timidity and doubt, the force at its command was paralysed by want of resolute direction. The "laws" were on the statute book, but there was no power to enforce them. And so the powers of evil did their terrible work; and fire and rapine continued to destroy life and property without check, until new power came in, when the reign of law was restored. And thus we are led to the culminating point of man's intellectual interpretation of Nature—his recognition of the unity of the power of which her phenomena are the diversified manifestations. Towards this point all scientific inquiry now tends. The convertibility of the physical forces, the correlation of these with the vital, and the intimacy of that nexus between mental and bodily activity, which, explain it as we may, cannot be denied, all lead upward towards one and the same conclusion, and the pyramid of which that philosophical conclusion is the apex has its foundation in the primitive instincts of humanity. By our own remote progenitors, as by the untutored savage of the present day, every change in which human agency was not apparent was referred to a particular animating intelligence. And thus they attributed not only the movements of the heavenly bodies, but all the phenomena of Nature, each to its own deity. These deities were invested with more than human power, but they were also supposed capable of human passions, and subject to human capriciousness. As the uniformities of Nature came to be more distinctly recognised, some of these deities were invested with a dominant control, while others were supposed to be their subordinate ministers. A serene majesty was attributed to the greater gods who sit above the clouds; whilst their inferiors might "come down to earth in the likeness of men." With the growth of the scientific study of Nature the conception of its harmony and unity gained ever-increasing strength. And so among the most enlightened of the Greek and Roman philosophers we find a distinct recognition of the idea of the unity of the directing mind from which the order of Nature proceeds; for they obviously believed that, as our modern poet has expressed it:

> "All are but parts of one stupendous whole,
> Whose body Nature is, and God the soul."

The science of modern times, however, has taken a more special direction. Fixing its attention exclusively on the order of Nature, it has separated itself wholly from theology, whose function is to seek after its cause. In this Science is fully justified, alike by the entire independence of its objects and by the historical fact that it has been continually hampered and impeded in its search for the truth as it is in Nature by the restraints which theologians have attempted to impose upon its inquiries. But when Science, passing beyond its own limits, assumes to take the place of theology, and sets up its own conception of the order of Nature as a sufficient account of its cause, it is invading a province of thought to which it has no claim, and, not unreasonably, provokes the hostility of those who ought to be its best friends. For whilst the deep-seated instincts of humanity and the profoundest researches of philosophy alike point to mind as the one and only source of power, it is the high prerogative of Science to demonstrate the unity of the power which is operating through the limitless extent and variety of the universe, and to trace its continuity through the vast series of ages that have been occupied in its evolution.

At the conclusion of the address Lord Chichester moved a vote of thanks to the President, during which he eulogised Dr. Carpenter's position in science and the services he had rendered to scientific progress.

At the close of the meeting Livingstone's boy, Kalulu, was presented to the Emperor Napoleon.

Proceedings on 15th August

Mathematical & Physical Science.—Mr. Warren de la Rue related to the mathematicians the latest observations that had been obtained in his fascinating study of astronomical photography. The eulogy of Americans being the order of the day, he did full justice to Mr. Lewis Rutherford's very successful delineation of the solar spectrum, which has furnished a much more refined analysis of rays than the lines of Angstrom and Kirchhoff. The late Professor Bond, of Harvard College, had also utilised photography in stellar observation, and obtained more exact results than those given by direct measurement. After describing the great preparations being carried on at Kew for observing the transit of Venus in 1874, Mr. De la Rue warned his *confrères* that astronomical photography was about to be subjected to the severest possible test in dealing with such a fundamental problem as the determination of the sun's distance from the earth. He had a confident anticipation, however, that it would prove itself equal to the occasion. Its long contest with those obstreperous phenomena, the "sun's spots," was drawing to a close. The spectroscopic observations of 1871 had definitely settled the composition of that solar envelope which Janssen proposed to call the "coronal atmosphere." He had to confess that nebulæ and comets were not yet amenable to photography, and great difficulties existed with respect even to planets. The main obstacle to success was atmospheric currents, which continually altered the position of images on the sensitive plate. Photographs of the moon are more free from distortion, and, proportionately, more reliance can be placed on selenographic evidence obtained from them. The theories of comets which had been propounded by Tyndall, Tait, Reynolds, and others had lately been superseded by the daring speculations of Professor Zöllner as to the luminosity of cometic trains. These substituted electrical excitement for mere combustion as the active cause, and the phenomena accorded perfectly with what had been observed in the development of electricity by vapour streams. Schiaparelli's remarkable identification of the paths of certain comets with great meteor streams invested this new theory with double interest. Mr. De la Rue was very cordially thanked through Lieut.-Colonel Strange for his review of this most entrancing of all the younger sciences. The mover facetiously endorsed his recognition of American rivalry. They had seen it in diplomacy, then in exact photography, and lately it had invaded a new department which previously they had considered their own—exploring Central Africa.

Mechanical Science.—In this section Mr. F. J. Bramwell, C.E., presided, and in his introductory address dealt with the subject of coal, which he regarded as the breath and life of the steam engine. He viewed the question in three aspects—geological, statistical, and the use and abuse of coal as a fuel. He believed that government interference in the production of coal would be most mischievous. The supply was finite, but a considerable per-centage in many districts would never be brought to the surface, because it would not be remunerative. There was great waste in domestic and manufacturing uses, and this sin would be a serious visitation upon our children; but he showed that this waste might to some extent be avoided by a utilisation of heat.

Mr. Hawkshaw believed it would be a good thing for the country if the supply of coal were reduced by one-half for a couple of years, as then the present high prices would not be maintained, and great economy would ever afterwards be ensured.

A paper by M. Bergeron was read, recommending the pneumatic system as a means of transportation, which he believed to be superior to and more economical than the present railways. The discussion was not favourable to the writer's theory.

Mr. P. Le Neve Foster, jun., gave a description of the new branch irrigation canal, leading from the Canal Cavour, and Mr. A. Wylie presented a paper on the Progress of Inventions as respects breech-loading small arms, during the past twenty years. But little discussion ensued.

Mr. Merrifield read an important paper by Mr. C. A. Bowdler on Aerial Navigation.

Geology.—The Geological Section opened in a masterly manner with an address by Mr. Godwin Austen, who had been chosen its president on account of his knowledge of the geology of the Wealden district. He reviewed the physical conditions under which the various oolitic strata had been disposed, and remarked that the Purbeck beds occupied a similar position relative to the oolitic and cretaceous deposits that the Permian and trias did to the primary and secondary strata. He showed that during the Wealden period Europe was occupied by large fresh water lakes, of which the most extensive was that where the Weald deposits were formed in Sussex. The Wealden area is elliptical in shape, and the English Channel so cuts through it that the extreme southern end lies in France.

Professor Hull next read a paper on the raised beach on the north-east of Ireland, which he sought to prove was identical with the raised beaches in Scotland, and due to a general rising.

Mr. Howe, F.L.S., read a detailed and elaborate paper on Brighton Cliff formation, the Coombe Rock, or "Elephant Bed," and another on the superetaceous formation in the neighbourhood of Brighton.

Professor Phillips paid a high compliment to the author of this paper.

Mr. Topley, F.G.S., then read the principal paper of the day on sub-Wealden explorations, in which he showed the general bearings of geological investigations on the distribution of the Wealden beds and the probability of primary rocks and coal being found beneath them. Ancient rocks had been found under the tertiary and chalk beds at Kentish Town and Harwich, and their strike was in this direction. He concluded by showing that these old rocks might or might not contain coal, and thought they could not be found at a less depth than 700 feet, and might be at that of 1700 feet.

Mr. Godwin-Austen expressed his belief in the probability of the coal measures being reached in the Ashburnham beds.

Mr. Henry Willett said the boring had been commenced, and the result might be a practical memorial of the meeting of the British Association in Brighton, in 1872. The size of the bore hole was nine inches, but the object in boring was not to search for coal, but to demonstrate the existence of primary rocks under the Weald, and thus settle a question about which geologists were at variance.

Mr. H. G. Seeley thought that if the carboniferous rocks were reached, the true coal measures would be absent, having been

denuded before the deposition of the secondary rocks.

CHEMISTRY.—In the chemical section the attendance was somewhat thin, but several papers of interest to scientific chemists were produced and discussed.

The President's (Dr. Gladstone) address was received with great interest, and was of a clear and popular character.

It showed how indebted all branches of occupation and study in life were to the science of chemistry, but he regretted to say that the prosecution of original chemical research in England did not seem to keep pace with that in other countries. He threw out the hint that large manufacturers who derived so much benefit from chemistry should found professorships or other methods of reward available for young men who had no balance at their bankers', and yet needed to live. The princely munificence of Mr. J. B. Lawes in giving his laboratory to the public accompanied with the sum of £100,000 was highly applauded.

BIOLOGY.—The business of the Biological Section was opened by the president, Sir J. Lubbock, reading an address, in the course of which he advocated the introduction of elementary science in public schools. Referring to the dispute between her Majesty's government and Dr. Hooker, the general feeling of the meeting was that the retirement of Dr. Hooker would be a misfortune to science, and hoped her Majesty's government would do nothing to retard or impede the valuable scientific work now going on at Kew. A committee meeting had been held that evening, when the following resolution was passed:—"That this committee would view with regret any change introduced into the botanical establishment at Kew which would tend to affect the completeness or to impair its scientific character, and that the attention of the council be called to the subject, that they may take any steps that they may deem desirable."

To this resolution the meeting gave cordial assent.

Dr. Carpenter, in moving a vote of thanks to Sir John Lubbock, said that he would have alluded to the Kew controversy in his opening address, but that he might have been tempted to express himself too strongly. (Cheers.) He deeply regretted that the higher Ministers of the Crown had not repudiated the views that had been expressed last Thursday by the First Commissioner. Mr. Lowe, he knew, objected on principle to open the public purse-strings for any object that could be achieved by private enterprise, but he was always willing to help forward any work which it was the duty of the nation to accomplish. They would all deeply regret if the difficulty that had arisen should lead to any change in the arrangements at Kew. Kew was the centre of the botanical study of the world, just as much as London was the centre of the money business of the world. He would only add that Dr. Owen, whose name had been dragged into the discussion in the House of Lords, had, some years ago, in a letter which he (Dr. Carpenter) saw, characterised Dr. Hooker as the successor of Dr. Brownie—Facile princeps Botanorum. (Cheers.) He did not know what resolution the Association might take in the matter, but it was possible they might think the best course would be to leave it where it stood.

ANTHROPOLOGY.—Col. L. Fox (Pres.) addressed this section in the following terms:—At one of their last meetings in Edinburgh a strong-minded lady had objected to the unscientific character of most of the papers that had been read. The colonel deprecated severe criticism on a science which was still in its infancy. He had to unravel his subject from the controversies which still rage about the origin of man. No one could, he thought, have sat at the feet of Sir John Lubbock without adopting his admirably-expounded views of the gradual and progressive development of civilisation, nor could there be any question of the proof which Professor Huxley had adduced that there was really no cerebral barrier between man and animals. The work to which anthropologists had of late had their attention specially drawn was the remarkable analogies found to exist between races in the same condition of progress. It was yet too early to apply to these phenomena either the hereditary theory or that of independent origin. There was but one existing race which retained the characteristics of a primeval people, and that was the Australians. In their arts they corresponded most closely of any people now living to those of the paleolithic age. Colonel Fox believes he has traced their boomerang and the rudimentary parrying shield to the Dravidian races of the Indian peninsula and to the ancient Egyptians—the same races which Professor Huxley had connected with the Australoid stock, and whose languages had disclosed a definite affinity with those of the Australians. Colonel Fox is not a theorist on the subject of the boomerang. He has acquired the art of throwing it, and practised on the Wormwood Scrubs with facsimiles of implements in the British Museum. But experience induces him to scout the objection that "the Dravidian boomerang does not return like the Australian." He succeeded in obtaining a return flight with one of the ancient weapons, and that, he holds, ought to settle the question of identity between them and the Australians. Bow-shooting had developed out of boomerang-throwing by a series of improvements arising from savage observation of the elastic properties of wood. The colonel felt as little doubt about this as he allowed his hearers to have cause of complaint about lack of plausibility in his exposition. In surveying the higher phases of civilisation, he laid great stress on the distribution of the metallurgic arts, and its divergence from the boundaries of the great primeval races. A line drawn from Behring's Straits southwest through Wallace's line would, by placing Australia to the eastward, divide the area of stone culture from that of metallurgic culture. It would, however, pass straight through the racial boundaries. The instability of language before it is reduced to writing is one of the most interesting of Mr. Taylor's observations on ancient culture. Colonel Fox cited his Australian friends in support of it, showing that though all the tribes throughout the continent had the same weapon they each called it by a different name. There was consequently a principle of variation counteracting that of continuity in operation among the customs and manners of savage races. With a Comptian courage of innovation, the Colonel proposed a new arrangement of archæological science and a redistribution of work among existing societies. The first should be Mr. Hyde Clarke's protohistoric archæology; the second, prehistoric archæology; the third, philology; the fourth, biology; and the fifth, descriptive ethnology. These heads, he believed, would include all the various classes of special workers. A step toward more methodical study of anthropology had been taken by the formation of a joint committee of the Geographical Society and the Anthropological Institute. From this it was hoped that a yet more intimate alliance would arise.

GEOGRAPHY.—Mr. Galton, the president, read his address. Two exploring reports were delivered to the section, one by the Rev. Dr. Ginsburg, and the other by the Rev. Canon Tristram. Both were copiously illustrated by charts and photographs, Canon Tristram alone having brought home a hundred and thirty of them. Mr. Galton having heard out a tedious controversy about the premature return of the expedition, pronounced a consolatory verdict that the British Association had obtained good value for its vote of £200 towards the examination of the Moabite stones. His own address did not wander at all into disputed fields of exploration. It confined itself to a practical home subject—the popularising of ordnance survey maps. After commending them for their unsurpassed accuracy and their delicate hill-shading, he regretted that they were not more accessible. Educated persons seldom see them, and to the middle and lower classes they were practically unknown. He accounted for this by the cumbrous form in which they were printed, and by their sale being in the hands of private mapmakers. Were they issued in quarter-sheets on thin paper fit to fold to pocket-size they could be sold directly by Government at its post-offices, of which there are now seven hundred in the kingdom. Mr. Galton made a further suggestion that printing in two colours would bring them nearer abreast of the present condition of cartography. It would effect not only an improvement, but an ultimate economy by diminishing the cost of revision. Sir Henry Rawlinson, who moved a vote of thanks to the president for his paper, and Admiral Ommaney, both supported his appeal to the Ordnance Survey Department.

The soirees at night were lively and agreeable. You could not imagine (said the daily press reports) a finer or more agreeable promenade than is formed by the combination of the museum, the dome, and the Corn Exchange. They communicate so entirely with each other, and the smallest of them is so spacious that, though all are in a manner crowded, there is not the slightest confusion. The promenaders, who are obviously ruled by a majority of ladies, allow themselves to be wafted along from saloon to saloon, from gallery to hall, from hall to gallery, till they have finished the circuit; then, like well-disciplined fashionables, they begin again in the museum, they stop a moment to glance at already familiar pictures in the reading room, they drop by twos and threes into a settee and have a chat in the dome, or they linger for a quarter of an hour, perhaps, to hear a glee or a canzonet by the London Glee and Madrigal Union. In the Corn Exchange they have greater difficulty of locomotion. At the door there is Mutton's buffet, with a resistless promise of ices; turn from that and you are arrested by a table bristling with microscopes, all adjusted invitingly for the eyes of the curious. The show-cases are now full to repletion, and the very floor is garnished with local antiquities. From one of them we learn that our benefactor of the ice-creams traces his genealogy back to the time of the Conquest. As tangible proof of his descent he exhibits an old oak chest which, according to a family tradition, came over from Normandy in the train of William the Conqueror. Without lowering our respect for its reported venerability one cannot but admire the care that has been taken of it. In a double sense it is better than new. The Willett collection of fossils very amply testifies to the past history of the Sussex coast. Not far from them is a set of later and more human relics. Two or three old photographs, and a small bust dropped as it at random on a corner of a table, remind us of the gifted preacher who was one of the celebrities of Brighton only a few years ago; they would suggest to many a Sunday visit to the late F. W. Robertson's chapel. Gayer thoughts have possession of this brilliant mercurial kaleidoscopic assembly, music and science blending together like sister Graces to bring a pleasant day to a happy close.

16th August.

GEOGRAPHICAL.—The President, Mr. Francis Galton, occupied the chair, and, after stating the proposed order of business, gave some explanations as to the recent Search Expedition fitted out by the Royal Geographical Society.

Mr. Stanley then said: Ladies and gentlemen, I consider myself in the light of a troubadour come to relate you the tale of an old man who is tramping onward to discover the source of the Nile—to tell you that I found that old man at Ujiji—(cheers)—to tell you of his woes and sufferings, and how he bore his misfortunes with Christian patience

(*Continued on page 135.*)

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LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY.

The Session 1871-72 is now ended.

Members whose subscriptions are now due will please to forward the same to the Collector, Mr. O. A. Stretton, 4, St. Martin's Place, Trafalgar Square, London.

Monthly Notices.

"E. D. H." on the Sale of University Degrees.—Reviews of Books postponed.—Technical Education.

THE meeting of the British Association, the great event of the past month, the proceedings of which, with the aid of the daily press reports, we chronicle in other columns of the present number, prevents our giving attention to minor passing events. However, we have space and opportunity for referring to a very able article by "E. D. H." (a signature many of our readers will not fail to recognise), in which he exposes the working of the very objectionable system of buying and selling University degrees, and shows that under cover of such a system people may be led to part with their money without really engaging in a transaction of *quid pro quo* as they expected.

The Association proceedings compel us to postpone several reviews, but we may now state that amongst these we have to commend the work of Mr. Wm. Pole, "On Iron as a Material of Construction"; Mr. Francis Trevithick's "The Life of Trevithick"; the second volume of the eleventh edition of Sir C. Lyell's "Principles of Geology"; and "Patterns for Turning," by Elphinstone.—The Lord Mayor has had a meeting of office-bearers of the City guilds at the Mansion House, on the subject of Technical Education, which resulted in an adjournment.

THE BRITISH ASSOCIATION.

MR. STANLEY'S DISCOURSE.

(*Continued from page* 134.)

and the endurance of a hero. Before I started for Central Africa I knew nothing of that great broad tract in the centre of the African continent. My duty led me to the fields of journalism; my duty carried me far away from Central Africa. If I had ever dreamt that I should visit the heart of Africa I should have smiled at myself. Now, while I was following my duties at Madrid I received a telegram to come to Paris on important business. I went, and I found Mr. James Gordon Bennett, the younger, of the *New York Herald*. (Cheers.) I found him in bed. I knocked at his door. He said, "Come in," and then demanded my name. "My name is Stanley." "Oh, you are the man I want. Do you know where Livingstone is?" I said, "I declare to you I do not." (Laughter.) "Do you suppose he is alive?" "I really don't know." "What do you think of it?" I replied, "It passes all my comprehension." (Laughter.) "Well, I think he is alive, and I want you to find him." (Laughter.) I thought it was a most gigantic task, but I dared not say "No" to Mr. Bennett. I answered, "If you send me to Central Africa I shall go there." (Loud cheers.) He said, "Well, go! I believe he is alive, and you can find him." I asked Mr. Bennett, "Have you the least idea how much that little journey will cost?" (Laughter.) The Burton and Speke expedition cost between £2000 and £4000. Are you ready to incur that expense?" Mr. Bennett responded, "Draw £1000, and when that is finished draw another £1000, when that is done draw another £1000, and when you have got rid of that draw another and another." (Cheers.) When I was in such a position what was I to do? I saw he was determined I should go and find Dr. Livingstone and I knew he would take no apologies or excuses, so I said, "What it is open to poor human nature to do I will do." I bade him good night. (Laughter and cheers.) Now, ladies and gentlemen, I had never read any book on Central Africa, and indeed, I thought Dr. Livingstone a myth. I knew books and newspapers had said much of him, and that all people gloried in him, yet I had a doubt of his being alive. Before I started on my mission I had to give a description of the scenery of the Suez Canal, and then I had to visit the vast Temple of Solomon under ground. Mr. Stanley then went on [illegible] other duties he had to discharge, which included journeys to the [illegible] Sea, Caucasus, Persia, Bagdad, the Euphrates Valley, [illegible], and other places. When I reached Zanzibar I began to study books on Central Africa, and to draw up an estimate of the cost of my expedition in search of Dr. Livingstone. I first put it down at 3500 dols., but I had to increase it several times until it reached 20,000 dols. Mr. Stanley then related the difficulty he had in learning the names of the currency among the natives in trading, and how he asked every Arab he met whether a white man had been seen in the country, and the conflicting information he received on the subject. One said he saw one at Ujiji and he was very [illegible]. (Laughter.) Another said a white man had [illegible] when he was engaged in hunting. When I got to Unyanyembe, the great central depot of the Arabs, I met the governor. I asked him where the fat man was. He said he lived at Ujiji somewhere, and was a great eater of butter. (Laughter.) I thought that was good news. I said, "Do you think he is alive?" "Ah! great master, I don't say he is alive, because there has been war there." He said he had lived on the Koran and found Livingstone was dead. Now my next point was Ujiji from Unyanyembe. I had never been in Africa before, there were no railroads, no telegraphs, no balloons, and there was a war raging in the country. First I must cut my way through this war country. We went on for two days, but on the third day we made a most disgraceful retreat. (Laughter.) All my men deserted me. I made my way to the camp of the Arabs, and I said, "There is a war going on, and it is between the Arabs and the natives. I will find my own way to Livingstone." One of them said, "O great master, you must not do that. I must write to the consul, and say you are obstinate; that you are going to get killed." "All right," said I, "there are jungles. If one way is closed, we can try another; if that is closed, we can try another, and so on. I want to go to Ujiji." So on the 23rd of September last year I started, and went directly south until I came to the frontier of the adjoining country, and when I came to the corner of it I found there was another war there. In fact, I was going straight into it. I had to go up north now, and came to the salt pans of which Burton speaks. In crossing the river I had such little incidents as a crocodile eating one of my donkeys. (Laughter.) I came next to a land notorious for its robbers. I didn't know this, and one night I called a council of my principal men. I told them I could not stand this tribute-taking. They asked "What will you do, master?" I said, "The thing is to go into the jungle and make direct west." At the dead of the night we went into the bamboo jungle, and on the fourth day we stood on the last hill, we had crossed the last stream, we had traversed the last plain, we had climbed the last mountain—and Ujiji lay embowered in the palms beneath us. (Cheers.) Now it is customary in Africa to make your presence known by shouting and shooting guns. We fired our guns as only exuberant hearts can do. I said, "I suppose I shall not find the white man here, we must go on to Congo and away to the Atlantic Ocean, but we must find this white man." So we were firing away, shouting, blowing horns, beating drums. All the people came out, and the great Arabs from Muscat came out. Hearing we were from Zanzibar and were friendly, and brought news of their relatives, they welcomed us. And while we were travelling down that steep hill to this little town, I heard a

voice saying, "Good morning, Sir," (Loud cheers and laughter) I turned and said sharply, "Who the mischief are you?" "I am the servant of Dr Livingstone, Sir." I said, "What! Is Dr Livingstone here?" "Yes, he is here; I saw him just now." I said, "Do you mean to say Dr Livingstone is here?" "Sure" "Go and tell him I am coming." (Laughter and cheers) Do you think it possible for me to describe my emotions as I walked down those few hundred yards. This man, David Livingtone, that I believed to be a myth, was in front of me a few yards I confess to you that were it not for certain feelings of pride I should have turned over a summersault. (Laughter.) But I was ineffably happy. I had found Livingstone My work is ended. It is only a march home quick, carry the news to the first telegraph station, and so give the word to the world. (Cheers.) A great many people gathered around us. My attention was directed to the head of the expedition, where a group of Arabs was standing, and in the centre of this group a pale, careworn, grey-headed old man, dressed in a red shirt, with a crimson joho, with a gold band round his cap, an old tweed pair of pants, his shoes looking the worse for wear. Who is this old man, I ask myself. Is it Livingstone? *Yes, it is.* No, it is not. Yes, it is. "Dr. Livingstone, I presume?" "Yes" (Loud cheers.) Now it would never have done in the presence of the grave Arabs, who stood there stroking their beards, for two white men to kick up their heels. No; the Arabs must be attended to. They would carry the story that we were children, fools. So we walked side by side into the verandah. There we sat. The man, the myth, and I. This was the man, and what a woeful tale of calamities that wrinkled face, those grey hairs in his beard, those silver lines in his hair—what a woeful tale they told. Now we begin to talk. I don't know about what. I know we talk—and by-and-by come plenty of presents from the Arabs. We eat and talk—and whether Livingstone eats most or I eat most I cannot tell. I tell him many things. "Do you know such and such a one?" "Yes. How is he?" "Dead." "Oh, oh And such a one?" "Alive and well?" "Thanks be to God! And what are they all doing in Europe now?" "Well, the French are kicking up a fuss, and the Prussians are around Paris, and the world is turned topsy-turvy." It is all matter of wonder for Livingstone. He soon turned in to read his letters—and who shall stand between this man and the outer world? I should like to say a great deal more to you; but I want you to find out one thing, and that is—I want you to find out what this man Livingstone was—what was his character—that this man can stand the fatigues, brave the dangers and sufferings of Central Africa? What is there in him which makes him go on, while others turn back? What is it in him, who has discovered so many lakes and rivers and streams, passed over so many virgin countries and through so many forests, that makes him say, "It is not enough?" This is what I want to know. I asked him if he had been up to the Lake Tanganyika yet. There is a great deal said about that. He said the central line of drainage absorbed all his means. I proposed to him we should go there with my men and material, and make a pleasure party of it. He said, "I am your man." I said, "They think that we should go there." "Well, it shall be done to-morrow." And to-morrow we went. Now, it is about what Livingstone and myself discovered at the northern end of Lake Tanganyika that the Royal Geographical Society has requested me to read you a formal paper on the subject. (Cheers.) Mr. Stanley then read his paper as follows:—

Ladies and Gentlemen of the Geographical Section—I have been invited to deliver an address here before you, or rather to read a paper on the Tanganyika. Responding to that invitation I came here; but, before entering upon that subject, which seems to interest this scientific assemblage, permit me to say something of your "distinguished medallist" and associate, Dr. David Livingstone. I found him in the manner already described, the story of which, in brief, is familiar to everybody. He was but little improved in health, and, but a little better than the "ruckle of bones" he came to Ujiji. With the story of his sufferings, his perils, and many narrow escapes, related as they were by himself, the man who had endured all these and still lived, I sympathised. What he suffered far eclipsed that which Ulysses suffered, and Livingstone but needs a narrator like Homer to make his name as immortal as the Greek hero's; and, to make another comparison, I can liken his detractors in England and Germany only to the suitors who took advantage of Ulysses's absence to slander him and torment his poor wife. The man lives not who is more single-minded than Livingstone who has worked harder, been more persevering in so good a cause as Livingstone—and the man lives not who deserves a higher reward Before going to Central Africa in search of Livingstone, I believed almost everything I heard or read about him. Never was a man more gullible than I. I believed it possible that the facetious gentleman's story, who said that Livingstone had married an African princess, might be correct I believed, or was nearly believing, the gentleman who told me personally that Livingstone was a narrow-minded, crabbed soul, with whom no man could travel in peace, that Livingstone kept no journals or notes, and that if he died his discoveries would surely be lost to the world. I believed then with the gentleman that Livingstone ought to come home and let a younger man that same gentleman, for instance—go and finish the work that Livingstone had begun. Also, inconsistent as it may seem—but I warn you again that I was exceedingly gullible I believed that this man Livingstone was aided in a most energetic manner, that he had his letters from his children and friends sent to him regularly, and that stores were sent to him monthly and quarterly—in fact, that he was quite comfortably established and settled at Ujiji I believed also that every man, woman, and child in England admired and loved this man exceedingly. I was deeply impressed with these views of things when James Gordon Bennett, jun, of the *New York Herald*, told me, in a few words, to go after Livingstone, to find him, and bring what news I could of him I simply replied with a few monosyllables in the affirmative, though I thought it might prove a very hard task What if Livingstone refused to see me or to hear me? "No matter," said I to myself, in my innocence, "I shall be successful if I only see him." You yourselves, gentlemen, know how I would stand to day if I had come back from the Tanganyika without a word from him, since but few believed me when Livingstone's own letters appeared. But how fallacious were all my beliefs! Now that I know the uprightness and virtue of the man, I wonder how it was possible that I could believe that Dr. David Livingstone was married to an African princess and had settled down. Now that I know the strict morality of his nature, the God-fearing heart of the man, I feel ashamed that I entertained such thoughts of him. (Hear, hear) Now that I know Livingstone's excessive amiability, his mild temper, the love he entertains for his fellow-men, white or black, his pure Christian character, I wonder now why this man was maligned. I wonder now whether Livingstone is the same man whom a former fellow-traveller of his called a tyrant and an unbearable companion. I wonder now whether this is the traveller whom I believed to be decrepid and too old to follow up his discoveries, whom a younger man ought to displace, now that I have become acquainted with his enthusiasm, his iron constitution, his sturdy frame, his courage, and endurance. I have been made aware, through a newspaper published in London, that there are hopes that some "confusion will be cleared up when the British Association meets, and Mr. Stanley's story is subject to the sifting and cross-examination of the experts in African discovery." What confusion people may have fallen into through some story I have told I cannot at present imagine, but probably after the reading of this paper the "experts" will rise and cross-question. If it lies in my power to explain away this "confusion," I shall be most happy to do so. There are also some such questions as the following propounded: Why did not Dr. Livingstone return with Mr. Stanley? Why was the great traveller so uncommunicative to all but the *New York Herald*? Why did not the relief expedition go on and relieve him? What has Dr. Kirk been doing all this time at Zanzibar? Here are four questions which admit of very easy solution. To the first I would answer, because he did not want to come with Mr Stanley, and, may I ask, was Mr. Stanley Dr. Livingstone's keeper, that as soon as he had found him he should box him up with the superscription, "This side up, with care?" To the second I would answer that Dr. Livingstone was not aware that there was another correspondent present at the interview when he imparted his information to the correspondent of the *New York Herald* To the third question, "Why did not the relief expedition go on and relieve him?" I would answer that Livingstone was already relieved, and needed no stores. (Hear, hear.) To the fourth question, "What has Dr. Kirk been doing all this time at Zanzibar?" I would reply that Dr. Kirk's relations in England may probably know what he has been doing better than I do. Also, in answer to that article, and to similar articles in other newspapers, I must confess that I cannot see wherein those letters of Dr. Livingstone to Mr. James Gordon Bennett are disturbing, grotesque, or unexpected, unless the editors believed that Dr. Livingstone was dead, and that his ghost now haunts them and disturbs their dreams We are also told that "Dr Livingstone's reports are strangely incoherent," that Sir Henry Rawlinson's letter is "most discouraging," that the only theory to be gleaned from Dr Livingstone's letters is "simply impossible." (Laughter) Here is a field for explanation had one only time or space in such a paper as this to explain. Let us hope that geographers who are in the dark will come forward to demand to be admitted into the light. But, leaving these tremendous questions to a subsequent moment, let us now turn our attention to that large body of water called the Tanganyika. England is the first and foremost country in African discoveries. Her sons are known to have plunged through jungles, travelled over plains, mountains, and valleys, to have marched through the most awful wildernesses, to resolve the many problems which have arisen from time to time concerning Central Africa. The noblest heroes of geography have been of that land. She reckons Bruce, Clapperton, Lander, Ritchie, Mungo Park, Laing, Baikie, Speke, Burton, Grant, Baker, and Livingstone as her sons. Many of these have fallen stricken to death by the poisonous malaria of the lands through which they travelled. Who has recorded their last words, their last sighs? Who has related the agonies they must have suffered—their sufferings while they lived? What monuments mark their lonely resting-places? Where is he that can point the exact localities where they died? Look at that skeleton of a continent! We can only say they died in that unknown centre of Africa—that great broad blank between the eastern and western coasts. Before I brought with me producible proofs in the shape of letters, his journal, his broken chronometers, his useless watches, his box of curiosities, it was believed by all, with the exception of a few, that the most glorious name among the geographical heroes—the most glorious name among fearless missionaries, had been added to the martyrology list; it was believed that the illustrious Livingstone had at last succumbed to the many fatal influences that are ever at work in that awful heart of Africa. It was in my search for this illustrous explorer, which now has ended so happily—far more successfully

than I could ever have anticipated—that I came to the shores of this great lake, the Tanganyika. At a little port, or bunder, called Ujiji, in the district of Ujiji, my efforts were crowned with success. If you will glance at the south-eastern shore of the Tanganyika, you will find it a blank; but I must now be permitted to fill it with rivers and streams and marshes and mountain ranges. I must people it with powerful tribes, with Wafipa, Wakawendi, Wakonongo, and Wanyamwezi, more to the south with ferocious Watuta and predatory Warori, and to the north with Manu Msengi, Wangondo, and Waluriba. Before coming to the Malagarazi, I had to pass through Southern Wavinza. Crossing that river, and after a day's march north, I entered Ubha, a broad plain country, extending from Uvinza north to Urundi and the lands inhabited by the Northern Watuta. Three long marches through Ubha brought me to the beautiful country of Ukaranga, and a steady tramp of twenty miles further westward brought me to the divisional line between Ukaranga and Ujiji, the Liuche Valley, or Ruche, as Burton has it. Five miles further westward brought us to the summit of a smooth hilly ridge, and the town of Ujiji embowered in the palms lay at our feet, and beyond was the silver lake, the Tanganyika, and beyond the broad belt of water towered the darkly purple mountains of Ogoma and Ukaramba. To very many here, perhaps, African names have no interest, but to those who have travelled in Africa each name brings a recollection—each word has a distinct meaning; sometimes the recollections are pleasing, sometimes bitter. If I mention Ujiji, that little port on the Tanganyika almost hidden by palm groves, with the restless plangent surf rolling over the sandy beach, is recalled as vividly to my mind as if I yet stood on that hill-top looking down upon it, and where a few minutes later I met the illustrious Livingstone. If I think of Unyanyembe, instantly I recollect the fretful, peevish, and impatient life I led there until I summoned courage, collected my men, and marched to the south to see Livingstone or to die. If I think of Wakonongo, recollections of our rapid marches, of famine, of hot suns, of surprises from enemies, of mutiny among my men, of feeding upon wild fruit, of a desperate rush into the jungle. If I think of Wakawendi, I see a glorious land of lovely valleys and green mountains and forests of tall trees, the march under their twilight shades, and the exuberant chant of my people as we gaily tramped towards the north. If I think of Southern Uvinza, I see mountains of hæmatite of iron—I see enormous masses of disintegrated rock, great chasms, deep ravines, a bleakness and desolation as of death. If I think of the Malagarazi, I can see the river, with its fatal reptiles and snorting hippopotamii, I can see the salt plains, stretching on either side. And if I think of Ubha, recollections of the many trials we underwent, of the turbulent contumacious crowds, the stealthy march at midnight through their villages, the preparations for battle, the alarm, and the happy escape, culminating in the happy meeting with Livingstone are recalled. There, in that open square, surrounded by hundreds of curious natives, stands the worn-out, pale-faced, grey-bearded, and bent form of my great companion. There stand the sullen-eyed Arabs, in their snowy dresses, girdled, stroking their long beards, wondering why I came. There stand the Wajiji, children of the Tanganyika, side by side with the Wanyamwezi, with the fierce and turbulent Warundi, with Livingstone and myself in the centre. Yes, I note it all, with the sunlight falling softly over the picturesque scene. I hear the low murmur of the surf, the rustling of the palm branches. I note the hush that has crept over the multitudes as we two clasp hands. (Applause.) To me, at least, these strange names have an enduring significance and a romance blended with the sounds. The connection between the Tanganyika and the Albert Nyanza was a subject of interest to all geographers before I went to Central Africa. I recollect the very many hypotheses raised upon this subject. Livingstone even was almost sure that the Albert Nyanza was no more than a lower Tanganyika, and indeed he had a very good reason for believing so. He had perceived a constant flow northward. All the Arabs and natives persisted in declaring that the Rusizi ran out of the Lake Tanganyika. Considering also that there was a tradition that Armanika, grandfather of Rumanika, present King of Karagwe, had thought of deepening the Kitangule flowing from the west to the Victoria Nyanza, in order to permit his canoes to proceed to Ujiji for trading purposes, I cannot see why he was not justified in thinking that there was some connection between the Tanganyika and the Albert Lake, or between the Tanganyika and the Victoria. Before I arrived at Ujiji he had never been to the north end of the Tanganyika, but as soon as I mentioned the interest and importance attached to it, and offered to escort him thither, he lost no time in preparing for the journey. Said he, in excuse for not having visited the northern head previously, "I never regarded it as of any importance. Tell the geographers at home that this was the reason. The central line of drainage absorbed all my attention and means." Our journey to the head of the lake it is unnecessary to describe here, it befits more the pages of a book. Livingstone used to call it a pic-nic, and I believe he writes of it in that sense to Lord Granville. I heartily concur with him, though the pic-nic had its drawbacks. As we hugged the coast of Ujiji and Urundi, looking sharply to every little inlet and creek for the outlet that was said to be somewhere in a day's pulling, we would pass by from fifteen to twenty miles of country. As we left our camp at dawn, after despatching our breakfast of Mocha coffee and dourra pancakes, with the men gaily shouting and chanting their lively chorus, echoing amongst the great mountains that rose up sometimes 2000 and 3000 feet above our heads, we did not know that our next camping place might be in an enemy's country. Who could guarantee our lives while camping in the country of Urundi? Several times we were in danger. Twice we were obliged to fly—twice our men kept watch all night, lest we might be surprised while asleep. Twice during the noonday heats we drank the exhilarating bohea with our eyes and ears painfully on the alert, for the enemy we knew to be on the search for us. These were some of the drawbacks to the pic-nic. It took us ten days' hard pulling to reach the head of the lake, a distance of nearly 100 geographical miles from Ujiji. Two days sufficed for the coast of Ujiji, the remaining eight we were coasting along the bold shores of Urundi, which gradually inclined to the eastward, the western ranges, ever bold and high, looking like a huge blue-black barrier some thirty miles west of us, to all appearances impenetrable and impassable. If the waters of the Tanganyika could be drained out, and we were to stand upon the summit of those great peaks which rise abruptly out of the lake, a most wonderful scene would be presented to us. We should see an extraordinarily deep chasm from 5000 to 7000 feet deep, with the large island of Ubwari rising like another Magdala from the awful depths around it; for I think that the greatest depth of that lake is near 8000 feet deep. Only two miles from shore I sounded, and though I let down 620 feet of line I found no bottom. Livingstone sounded when crossing the Tanganyika from the westward, and found no bottom with 1800 feet of line. The mountains around the northern half of the Tanganyika fold around so close, with no avenue whatever for the escape of waters save the narrow valleys and ravines which admit rivers and streams into the lake, that were it possible to force the water into a higher altitude of 500 feet above its present level its dimensions would not be increased very considerably. The valley of the Malagarazi would then be a narrow deep arm of the lake, and the Rusizi would be a northern arm, crooked and tortuous, of sixty or seventy miles in length. The evening before we saw the Rusizi a freedman of Zanzibar was asked which way the river ran—out of the lake or into it? The man swore that he had been on the river but the day before, and that it ran out of the lake. Here was an announcement calculated to shake the most sceptical. I thought the news too good to be true. I should certainly have preferred that the river ran out of the lake into either the Victoria or the Albert. The night we heard this announcement, made so earnestly, Livingstone and myself sat up very late speculating as to where it went. We resolved if it flowed into the Victoria Nyanza to proceed with it to that lake and then strike south to Unyamyembe, and, if it flowed into the Albert Lake, to proceed into the Albert and cruise all around it, in the hope of meeting Baker. As there was war between the rival tribes inhabiting the banks of the Rusizi the King Mokamba advised us to proceed to his brother's village in Mugihewa by night, which was situated about 800 yards from the river, on the right bank. Just after dark we started, and in the morning we arrived at Mugihewa. After a cup of coffee we manned our canoe, and having prepared our guns we started for the mouth of the river. In about fifteen minutes we were entering a little bay about a mile wide, and saw before us to the north, a few hundred yards ahead of us, a dense brake of papyrus and matete cane. Until we were close to this brake we could not detect the slightest opening for a river such as we imagined the Rusizi to be. We followed some canoes which were disappearing mysteriously and suspiciously through some gaps in the dense brake. Pulling boldly up we found ourselves in what afterwards proved to be the central mouth of the river. All doubt as to what the Rusizi was vanished at once and for ever before that strong brown flood, which tasked our exertions to the utmost as we pulled up. I once doubted as I seized an oar that we should ever be able to ascend; but after a hard quarter of an hour's pulling the river broadened, and a little higher up we saw it widen into lagoons on either side. The alluvial plain through which the river makes its exit into the lake is about twelve miles wide, and narrows into a point after a length of fifteen miles, or a narrow valley folded in by the eastern and western ranges, which here meet at a distance of a couple of miles. The western range, which inclines to the eastward, halts abruptly, and a portion of it runs sharply north-westward, while the eastern range inclines westward, and after overlapping the western range shoots off north-westward, where it is lost amid a perfect jumble of mountains. The chief, Rubinga, living at Mugihewa, is the principal chief in Usige. He is a great traveller. Born in Urundi, he has been to Karagwa and Ruanda, and came to Usige when quite a young man. Though a pleasant cynic in his way he shared in our enthusiasm as if he had been an Associate of the Geographical Section, and entered very readily into a discussion about the mooted points which still remained unsolved. Briefly, he said that the Rusizi rose from the Lake Kivo, a lake fifteen miles in length and about eight in breadth. Kwansibura was the chief of the district in north-eastern Urundi, which gives its name to the lake. Through a gap in a mountain the river Rusizi escaped out of Lake Kivo. On leaving Kivo Lake it is called Kwangeregere; it then runs through the district of Unyambungu, and becomes known as the Rusizi or Lusizi. A day's march from Mugihewa, or, say twenty miles north of the mouth, it is joined by the Luanda, or Ruanda, flowing from a north-westerly direction, from which I gather that the river Luanda is called after the name of the country—Ruanda, said to be famous for its copper mines. Besides the Luandi there are seventeen other streams which contribute to the Rusizi; these are the Mpanda, Karindwa, Wa Kanigi, Kaginissi, Kaburan, Mohira, Niamagana, Nya Kagunda, Raviro, Rofuba, Kavimvira, Mujeve, Ruhuhha, Mukindu, Sange, Rubirizi, Kiriba. Usige, a district of Urundi occupying the head of the

lake, extends two marches into the north, or thirty miles; after which comes what is called Urundi Proper for another two days' march, and directly north of that is Ruanda, a very large country, almost equal in size to Urundi. Rubinga had been six days to the northward. There were some in his tribe who had gone further but from no one could we obtain any intelligence of a lake or of a large body of water, such as the Albert Nyanza, being to the north. Sir Samuel Baker has sketched the lake as being within one degree north of the Tanganyika, but it is obvious that its length is not so great as it is represented, though it might extend thirty or forty miles south of Vacovia. Ruanda, as represented to us by Rubinga, Mokamba, chiefs of Usige, and their elders, is an exceedingly mountainous country with extensive copper mines. It occupies that whole district north of Urundi Proper, between Mutumbi on the west, and Urundi on the east, and Itara north-east. Of the countries lying north of Ruanda we could obtain no information. West of Urundi is the extreme frontier of Manuyema, which even here has been heard of as the land of the cannibals. In returning to Ujiji after the satisfactory solution of the river Rusizi we coasted down the western shore of the Tanganyika, and came to Uvira at noon of the following day. We were shown the sandy beach on which the canoes of Burton and Speke had rested. Above, a little south of this, rises the lofty peak of Sumburizi, fully 4500 feet above the level of the lake. Viruti, the chief of Uvira, still lives in the village he occupied when Burton and Speke visited his dominions. A day's march or fifteen miles south of this Uvira narrows down to the alluvial plains formed by the numerous streams which dash down the slopes of the western range, while the mountainous country is known as Ubembe, the land of the cannibals, who seldom visit the canoes of the traders. South of Uvira is Uansi, peopled by a race extremely cannibalistic in its taste, as the Doctor and myself had very good reason to know. I think if we had had a few sick or old men among our party we could have disposed of them to advantage, or we might have exchanged them for vegetables, which would have been most welcome to us. From [illegible] we struck off across the lake, and, rowing all night, at dawn we arrived at a port in Southern Urundi. Three days afterwards we were welcomed by the Arab traders of Ujiji as we once more set foot on the beach near that bunder. We have thus coasted around the northern half of the Tanganyika, and I might inform you of other tribes who dwell on its shores; but the principal object of my paper was to show you how we settled that vexed question, "Was the Rusizi an effluent or an influent?" There is, then, nothing more to be said on that point. But, gentlemen, I must ask your permission to deliver a message from your great associate Livingstone, who long before this has left Unyanyembe, and is plodding onward to the scene of his late discoveries. He told me to tell you that he wants no companion now, that he requires no more stores, that when he has satisfied himself of the sources of the Nile he will come home, and give you such reports as must satisfy you. With plenty of stores, and over seventy good men well armed and equipped, he is now *en route* to Ujiji, healthy and strong, and as enthusiastic as ever. Having delivered my message I conclude with thanking you for the attention with which you have listened to me. (Loud applause.)

The President: You have amply testified by your applause your appreciation of the touching and interesting narrative you have just heard. One almost regrets—if one might be allowed to parody a remark of Sydney Smith's—that more eminent African discoverers were not lost in Africa, and that more able correspondents like Mr. Stanley have not gone there in search of him. (Cheers.) I will say no more now because we have much to do. I will simply ask Mr. Stanley how much further Lake Tanganyika extends to the northwards than the furthest point reached by Captains Burton and Speke.

Mr. Stanley: Captains Burton and Speke halted on a sandy patch thirteen miles from the extremest end of Tanganyika. Had they gone halfway up the mountain referred to in my address, where resided the King of Urundi, they must have seen the northern end of Tanganyika plainly, but resting where they did, they simply reached the point where the eastern and western ranges meet, and where the eastern overlaps the western. At the extremest end Tanganyika is fifteen or sixteen miles broad.

The President: I should like to ask another question, and that regards the sweetness or the brackishness of the water of Lake Tanganyika. This is important, because the question of whether the Rusizi is an affluent or influent depends upon the character of the water.

Mr. Stanley: I could not wish a nicer or sweeter water to make a cup of tea or coffee than the water of Lake Tanganyika. (Laughter and cheers.)

Mr. Clements R. Markham then read extracts from Dr. Livingstone's Foreign Office despatches.

Mr. Stanley, in reply to a further question put by the President, explained that many of the places marked on the existing maps did not correspond with the places where they were put on the maps of Dr. Livingstone.

Mr. C. R. Markham next read the following paper from Colonel Grant, a portion of which had only arrived by post that morning:—"The two letters from Dr. Livingstone to Mr. Gordon Bennett, of the *New York Herald*, inform us that he had traced the southern waters from 11 to 5 south latitude, and he supposed that they must flow on to the Nile by the Bahr Gazal at 9 degrees north latitude. I must say that this is an extravagant idea, which cannot be for a moment entertained, for there are many circumstances precluding such a thing. The distance still unexplored by Dr. Livingstone may be roughly stated as 1,000 miles between his most advanced position and the mouth of the Gazal. In this distance we have Speke's Mountains of the Moon, and the great bend to the west of the Nile at 7 8 north latitude, as the principal obstructions to Dr. Livingstone's theory. We have also 300 miles of longitude between the two positions. But the curious objection to Dr. Livingstone's reaching the Nile is the fact that we already know that the source of the Gazal was visited and determined a few years ago by the eminent botanist Schweinfurth, who fully satisfied all geographers that the source of the Gazal is north of the equator, and not, as Dr. Livingstone supposes, 11 degrees south of it. My observations on the Gazal, made in March, 1863, when descending the Nile from Gondokoro with my late companion show that it is insignificant when compared with the Nile. It seems to be a swamp with little current, for the Nile branch along which we were sailing was not increased in width by the water of the Gazal. The Nile maintained its width of 100 yards till after the Geraffe and Sobat joined it, and then the stream was increased to a width of 500 yards. The Gazal had no perceptible stream; at the junction its waters were still, and looked like a backwater, half a mile across, and surrounded by rushes. Our boatmen and others told us that no boats were able to ascend it that year (1863), as its channel was choked with reeds and the Gumbatch tree. There is, therefore, no regular traffic on it by boats. Some years it is completely blocked—a contrast to the Nile which is navigable to large craft all the year round between Gondokoro and Khartoom. If anything were wanting to prove that the Gazal has no connection with the southern waters of Livingstone, reference might be made to several men who have been in the Gazal country; but Dr. Schweinfurth, who is now in Europe, would be most able to give definite information. The narrative of Dr. Livingstone contains some curious incidents which are quite novel to me; for in our journey from Zanzibar to Egypt, when travelling on the watershed of the Nile, we never saw any trace of cannibals or any signs of gorilla; neither did we find that any race of natives kept pigs in a domesticated state. They ate one species of wild hog, but no race of natives in the valley of the Nile was ever seen to keep pigs tame. Oysters must be a misprint. Taking into consideration these remarkable differences from the country we traversed, I cannot but think that Dr. Livingstone, having no chronometers to fix his longitude, has got farther to the west than he supposes, and that he has been amongst races similar in most respects to those on the west coast of Africa visited by Mons. du Chaillu. In conclusion, this fresh discovery of lakes and rivers by Livingstone defines a distinct new basis, and leaves clearer than ever the position given by Speke to the Nile in 1863."

Consul Petherick said that he was the first Englishman who ever navigated the Bahr-il-Gazal. He navigated it in 1853, and since then he had navigated it annually up to 1858. He had no astronomical instruments, and his account was kept by dead reckoning. He reached the head-waters going southwards—it was then a large lake. He navigated it in several directions to find an outlet. He navigated it afterwards in 1862 or 1863. It was then a swamp reduced to the breadth of his boat, and it was with the greatest difficulty that he navigated it at all. When he first navigated it it was very much swollen, and was then in the same condition which he believed the Victoria Nyanza was in when Captain Speke was there. The lake was then inundated, and appeared much larger than it was found to be in subsequent years. He fully believed he had a proof of that in ascending the Gondokoro, where he found what Captain Speke found. He found its banks were overrun with water, and he had to go over ninety miles of water before he could reach land. It was said that the Bahr-il-Gazal was overrun with weeds, and he sent a man to try to get into it. The boat was driven back. In 1853 he took a more numerous expedition, and succeeded. The water was much reduced, which was to be accounted for by the greater or less quantity of rain falling in Central Africa. On returning he measured the volume of water, and above the Bahr-il-Gazal it was 18,000 feet a second. The Bahr-il-Gazal it was impossible to measure, and he was obliged to go down, and he found the water going into the Bahr-il Gazal to be a little more than one third the volume of that going down the Nile. He believed he had fully satisfied himself that the waters flowed to the southward. There must be a watershed separate from that of Bahr-il-Gazal, and the watershed must be from east to west. It was certain that Dr. Livingstone must have made a mistake in believing that the eastern Nile water flowed through the Bahr-il-Gazal. Dr. Livingstone had given him an honour that did not belong to him. He did not claim to be the discoverer of the sources of the Nile, but merely to be the discoverer of some of the tributaries. The water that Dr. Livingstone was pursuing northwards must find some other outlet—where he did not profess to show.

The President said, leaving the question of the Bahr-il-Gazal, he wished to ask whether the water it contributed to the Nile was or was not equivalent to the Lualaba of Dr. Livingstone.

Mr. Petherick said, judging from the despatches sent home by Dr. Livingstone, he should say it contained a good deal more water. A native told him that the Lualaba was but a short distance off; but all who had travelled in Africa knew that no reliance could be placed on the statements of the natives in those matters, as very few, if any, of them ever went beyond the frontiers of the district inhabited by their own tribe.

The President then called on Mr. Oswell, through whose assistance it was, he said, that Dr. Livingstone had penetrated into Central Africa. Mr. Oswell eulogised Mr. Stanley's conduct, after which Dr. Beke was called upon by the chairman. He recognised the

great value of the discoveries Dr. Livingstone had made; but he was convinced that he had not discovered the source of the Nile. Evidence of this was to be found in what he himself reported as to the level of the different waters he had met with, but a much more important objection to the theory that the source of the Nile had been found arose from Dr. Schweinfurth's explorations. That traveller had gone to the south. He had crossed the Wellin—a large river flowing from east to west in latitude 3·45, and it appeared that that river rose in the Blue Mountains to the west of Albert Nyanza, and completely cut off the basin of the Nile. The mere fact of the existence of a river running from east to west at the place in question must be held as proof that it cut off completely the waters of the Nile, and the waters Dr. Livingstone referred to must either go into the Wellin or turn round and go into the Congo, or most probably into some great lake. But joined to the Nile they could not be. (Hear, hear.)

Sir Henry Rawlinson was very glad of this opportunity, as the President of the Royal Geographical Society, to bear testimony to the great value which they attached to Mr. Stanley's services in searching for Dr. Livingstone —(cheers)—and to express the high opinion they had of his merits as a traveller. (Cheers.) That he should have succeeded in forcing his way from the sea to Tanganyika, through a country desolated by sickness and war, and that he should have successfully overcome all the difficulties and dangers in his way in order to succour Dr. Livingstone, reflected the greatest credit upon him and also upon the country with which he was connected. (Cheers.) As there had been some misconception on the subject, he took this opportunity of disclaiming on the part of the Royal Geographical Society the slightest feeling of jealousy. (Cheers.) He was especially glad to be able to refer to the address which he had delivered to the Royal Geographical Society at the commencement of last session, when he announced Mr. Stanley's journey, wished him every possible success, and stated that if he succeeded he would be received in this country with the same cordial spirit and the same honour as any Englishman would. (Cheers.) He would now, with their permission, make a few remarks on the geographical question—upon the work on which Dr. Livingstone and Mr. Stanley had been engaged; he meant the exploration of inner Africa. Dr. Livingstone's great discovery was this great system of river drainage in inner Africa, but he had strong misgivings as to whether he was upon the Nile basin. He might have been upon the Congo. Dr. Livingstone's doubts were raised no doubt by the levels and the tale told by his own instruments. He followed up this great river system from the watershed, 7000 feet high, to the point 4 south latitude, where, according to his aneroid barometers, he had reached a level of about 2000 feet. What became of this great river system it was impossible for them authoritatively to determine. All that they knew was that this extensive river system had been found in the middle of Africa. The ascertaining of the points to which these rivers flow must await further discovery, which he trusted would be made by Dr. Livingstone himself, for he (Sir H. Rawlinson) should be sorry if he did not carry out the great work on which he had been so long engaged to a successful issue. In a matter of this kind they must at present be satisfied with conjecture; but, putting all the arguments side by side, and comparing the results one with another, his leaning was to the supposition that the great river system formed a large central inland lake. He should doubt if it ever reached the Tchad. There is a great space in the interior of the continent which might well be occupied by such a lake, which would drain all the surrounding mountains and the western slope of the hills which bound Albert Nyanza and the Bahr Bazul, as well as absorb all the drainage from the south. The discovery of that lake would, he trusted, crown the African labours of Dr. Livingstone. At the present moment he was on his way to the sources of those rivers, and then having satisfied himself on that point, he would turn northwards with the supplies with which he had been furnished, in a great measure through Mr. Stanley, and follow down the stream beyond the point where he was previously arrested. His great difficulty on former occasions was through the incapacity or hostility of his attendants. It was gratifying to know that he had now at his command a body of efficient, faithful followers. He was thus in a position to follow out his discoveries to their legitimate issue; and he (Sir H. Rawlinson) only trusted that he would soon ascertain where the river system debouched, which would be the crowning result of his African travels. (Cheers.)

(To be continued in our next.)

FLAT-IRONS WITH MOVABLE HANDLES.

As we think highly of those efforts of the inventive faculty which result in rendering the transactions of every-day life more facile or agreeable, it is with great pleasure we devote a portion of our space to the description and illustration of what appears to be a very commendable invention as regards domestic utilities.

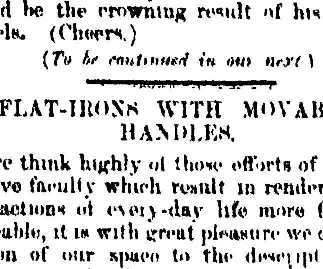

Fig. 1

Fig. 2

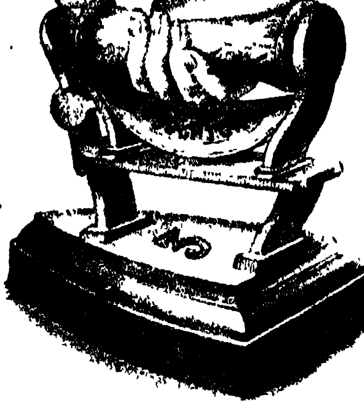

Fig. 3

These irons possess advantages which recommend them beyond all irons now in use. By simple but effective means the hand is protected from the heat emitted by the body of the iron, and the disagreeable and prejudicial effects of using the present style of iron, the handles of which are constantly hot when in use, are avoided. The "holder" or "wrapper" is dispensed with, and great comfort and cleanliness are insured.

These advantages are secured by making the handles detachable, as shown in the engravings. By pressing the thumb upon the spring catch (see figure 2), the handle is released from the body of the iron. When the iron is heated ready for use, the handle is affixed by pressing it to the iron, keeping the catch open, and the handle then adjusts itself. The mechanism is simple and easy to work, and cannot be deranged. To further protect the hand a tin shield is affixed (see figure 1), and the part of the handle grasped by the hand is made of wood. By these means the handle is preserved perfectly cool even after many hours' use.

The patentees pride themselves in producing their iron with a perfectly flat surface. The handles are interchangeable—No. 1 handle may be used with either 3, 4, or 5 lbs irons; No 2 handle with 6, 7, or 8 lbs. irons. The patentees and sole manufacturers are A. B. Houghton and Co., 19, Albion Street, Birmingham.

COWARD'S IMPROVEMENTS IN MOVABLE CARRIAGE HEADS.

To the cantrail of the carriage, which is hinged to the pillar top, the inventor (by means of a fixed axis secured to said cantrail) attaches, free to work on said axis, a lever; the other or lower end of which lever is secured (free to work) to a fixed axis, which is secured to the "elbow" in the carriage frame. The lower end of this lever it is proposed to provide with a quadrant projection, with a notch, which is to work in connection with a guide nut or stud, so as to keep the pillar top in proper position with the pillar when the door is shut, and opposite this quadrant arrangement (to a projecting piece as preferred) the end of a connecting chain or connector is secured, the other end of which is connected to a barrel spring or other similar spring, the barrel being secured to the carriage frame.

In use, when the pillar top is pressed back the cantrail is thereby moved, and the lever which is connected to the cantrail is moved therewith, and the spring attached to the lever drawn out so as to allow the pillar top to be pushed down completely, the cantrail being thrown out in a line with the pillar top, and so remaining until someone pushes it up again. The inventor is Mr. Coward, of Brixton.

ANTI-NOISE INVENTION.

The object of this invention, as above stated, is the prevention of noise, breakage, and other inconveniences arising from bringing vessels or articles such as jugs and bottles, for instance, into contact with hard substances, as, for instance, when a jug or other article is placed upon the marble slab of a side-board or washing-stand, or on a table of mahogany or other hard material, the said improvements also preventing scratching or disfiguring of the slab or table. And this invention is effectuated by the adaptation of soft and noiseless material to the bottoms of jugs, decanters, and other vessels or articles constructed of glass, earthenware, or other materials of similar resonant or breakable character.

To carry out this invention the bottom of the vessel or article is constructed with an endless groove, into which india rubber tubing or other similar material is fixed, care being taken that the groove shall be so small in comparison with the bulk of the rubber or soft material that when placed therein its pressure will cause it to fit tightly in its place, and the rubber or other soft material be allowed to protrude outside the said groove, so that the said rubber or soft material may take the contact with the hard substance on which the vessel or article may be placed. When found necessary cements, pins, or fastenings may be used in order to ensure the rubber or soft material keeping its position in the groove or hollow. Sometimes instead of an endless groove a number of small grooves or hollows are provided, into which the rubber or soft material is fitted in manner before described, and sometimes the bottom of the vessel or article is encased with india-rubber or soft material. The inventor is, Captain Gilmour, R.N.

APPLICATIONS FOR LETTERS PATENT.

(Continued from page 130.)

2166. W. Eades and W. T. Eades. Tube cutter and wrench.—2167. J. Richardson. Arranging, actuating, and controlling cut-off slide valves of steam and other engines.—2168. J. Lake. Steam boilers.—2169. M. Henry. Measuring and indicating time (com.)

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* "Com." means "Invention communicated from abroad."

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The Scientific Review.

OCTOBER 1, 1872.

FOOD AND FUEL.

The Potato disease is again effecting its ravages; the Cattle disease is rife amongst our flocks and herds; and Coals are dear. Can our men of science and our inventors help us out of our troubles? Doubtless they can do much, if not for the removal, yet for the mitigation of them.

As to the Potato disease that is evidently a matter for our agricultural chemists and men of practical science who give attention to the cultivation of the soil; but we would just throw out the suggestion that to prevent the recurrence of this disease it would be as well to try the raising of crops from healthy foreign fruit-seed instead of continuing to plant native tubers without change or intermission We believe this is no novelty, but being one of those expedients which has its drawbacks, is so neglected that a reminder of its possible usefulness may not be without advantage.

With regard to the Cattle disease much may be done by our sanitarians, and it is a comfort to know they are actively at work; but much may also be done in the way of economising the preparation and use of animal food. For ourselves we are fully impressed with the notion that John Bull is a wasteful, dainty creature. He has lived so many years surrounded with plenty of the best of good things, that he is unable to comprehend the propriety, not to say necessity, of using them carefully and without waste; and he has such a delicate palate that every edible in vogue with him must please his taste to the full or he will have none of it. But although he is very dogged in this as in many other matters, and cannot be driven, it is not impossible to coax him into a right view of things. He abjures Australian meat, and well he may if called upon to inspect the uninviting contents of the tin cases when opened; but let him not be required to do so, but simply solicited to taste some of the meat artistically cooked, and when he finds it savoury and nice he will want the dose repeated: so that what is required is good cookery, which should be, like many other things, taken up as a matter of practical science, not treated as a mere matter of kitchen drudgery. Another Soyer would work wonders for us in this matter.

Again, economy in the use of our home-grown food-stuffs is a thing that needs the efforts of our inventors to be brought to bear upon this branch of everyday life. And, by the way, we think that it would be advantageous to increase the number of our cattle and our flocks; and that this is no mere Cockney fancy, we may mention that we recently found a very excellent journal, published in Kirkcudbrightshire, adopting from the *Ayr Observer* a suggestion that "Scotland might produce more cattle, and Ireland still more than they do"; to which we would add, England also. Let us if need be dispark all our parks rather than have our population stinted in good wholesome food; though we confess we do not see the necessity for such an extreme measure, for we have simply to give less attention to the production of bread-stuffs, which we can easily get from abroad, and pay more attention to increasing our home supply of animal food, which we cannot so easily and advantageously bring in from foreign parts.

In the matter of Fuel inventors can do much for us in increasing the sources of supply, and also in economising the use of our coals. To increase the sources of supply of fuel much might be done. For instance, we have large fields of peat in the United Kingdom, and by proper treatment this is quite capable of being rendered valuable fuel. We are aware that much has been done in this direction, but up to the present time no system of treatment of peat which is at once practical and cheap has been brought into public operation.

Again, there are petroleum and the various hydro-carbons that could be brought into competition with coal-gas as a fuel, if we had only suitable stoves or apparatus which would enable us to utilise these substances in the way required. And, whilst speaking of stoves, we are led to remark that much might be done for us by inventors supplying us with heating apparatus which would give out all the heat of the fuel to our rooms and bodies, and not, as in the common open fire-grate, send the larger proportion of the heat up the chimney; or, as in the close stoves sometimes used, stifle us with "burnt air," as it is termed. Though we are willing to admit that the Englishman's propensity for "poking the fire" is a serious drawback in the way of any economical improvement in stoves, and we are free to own that a close stove in which the "firelight" cannot be seen does really deprive us of a source of home cheerfulness that an Englishman cannot help considering a great desideratum; but we think, although the poker might be done away with, the reflection of the firelight need not be removed from our dwellings.

There is yet another way in which our poverty in fuel might be rendered less hurtful—that is, by rendering its use less necessary for industrial purposes, and thus getting free a large amount of fuel for domestic use. Let us have engines which do not require steam as the *primum mobile*—let us improve our system of water power, not forgetting the tidal force, which has never yet received the attention from our inventors which it deserves.

One other matter is worthy the consideration of inventors. Some years ago there was a great deal said about making gas from water; that was in the palmy days of the Polytechnic Institution, we believe, and the experiment, if we remember rightly, was not wholly unsuccessful. Though the manufacture of gas in this way was not a practical commercial success, yet the conclusions arrived at were, according to our recollection, not of such a character as to shut out all hope that at some future time this great object might be attained.

Upon reviewing the whole question we see no reason why all our difficulties should not be entirely removed out of the way by the application of prudence, of adaptiveness to the circumstances of the case and inventive ingenuity; and we trust all whom it may concern will give heed to the foregoing suggestions, and that the threatened dearth of fuel and food may, as regards working any serious injury, be reduced to the category of nine days' wonders.

Reviews.

Contributions to Molecular Physics in the Domain of Radiant Heat. A Series of Memoirs published in the "Philosophical Transactions and Philosophical Magazine," with Additions. By JOHN TYNDALL, LL.D., F.R.S., Professor of Natural Philosophy in the Royal Institution. London: Longmans, Green, and Co. 1872.

PROFESSOR TYNDALL'S merits as a man of science and scientific author are so well known and highly esteemed that anything in the way of encomium is mere superfluity. All we need say is that these "contributions" are highly interesting and instructive. The general nature and character of the work will be best described in Dr. Tyndall's own words:—

"In the preface to the third edition of my work on heat, written in January, 1868, the hope was expressed that before the end of that year the original memoirs which I had contributed to the 'Philosophical Transactions,' and other journals, during the previous eighteen years, would be presented to the scientific public. Hitherto this hope has been only partially fulfilled by the publication of the researches on Diamagnetism and Magnecrystallic Action.

"The present volume contains the memoirs on radiant heat, considered as an explorer of molecular condition. I have read them over carefully, and have tried to augment their clearness without altering their substance.

"In front of each memoir is placed an analysis of its contents, from which the reader can at once learn the nature of the inquiry. I have also added here and there some necessary historic data.

"The points of difference between the late Professor Magnus and myself regarding the action of air and that of aqueous vapour on radiant heat are placed in their proper sequence and relation. At the end of the series of memoirs the discussion is resumed, and brought, I trust, to a fair conclusion.

"I ought to inform the reader who desires but a partial or general acquaintance with these researches, that summaries of most of them have been already published in the various editions of my work on heat."

It will thus be seen that the present work is more of the nature of a collection of treatises already before the world rather than an essentially new book.

Iron as a Material of Construction; being the substance of a course of lectures delivered at the Royal School of Naval Architecture, South Kensington. Revised and enlarged, to form a hand book for the use of students in engineering. By WILLIAM POLE, F.R.S., &c. London: E. and F. N. Spon, 48, Charing Cross. New York: 446, Broome Street. 1872.

PROFESSOR POLE (for by this name he is still known, although he is no longer Professor at University College, London) is *nulli secundus* amongst true men of science, and hence any treatise from his pen is worthy of serious attention; and certainly the present work is one deserving of the highest praise.

In the preface of this work its author informs us that, having a few years ago given to the students of the Royal School of Naval Architecture at South Kensington a series of lectures on "The Use and Application of Iron to form Mechanical Structures," he has since had it suggested to him that the matter prepared for these lectures might be made useful in the technical education of other students in engineering; and although the great school for acquiring this knowledge must be practical experience, yet no one can doubt that much may be usefully done to prepare the way by placing before the student the large amount of information already collected on the subject by competent hands.

To do this in a simple, clear, and convenient manner has been the object in the present publication, and Mr. Pole claims no originality or novelty in the scientific treatment of the subject, and the experimental data are, of course, due to the various authorities whose names are attached to them. But for the general authority of the work he pleads a practical experience of forty years in the use and application of iron for engineering purposes, and an extent and variety of opportunity for observation which fall to the lot of few.

The original lectures have been revised and considerable additions have been made, with a view of rendering the information more complete and of bringing it down to the present state of knowledge, but the colloquial and familiar style of the first composition has not been altered.

The author further states that in a work which professes to compile useful information from all available sources it has been impossible to give special references in every case, but he gives a list of works consulted, and expresses in a single acknowledgment his indebtedness to them, and recommends them emphatically to all engineering students who may wish to carry further their study of the great subject offered to their notice in his work.

Amongst these works are those by Frederick Overman, of Philadelphia; Sir William Fairbairn, F.R.S., &c.; W. Truran; Dr. John Percy; H. Bauermann, F.G.S.; William Crookes, F.R.S., and Ernst Rohrig; Peter Barlow; Thomas Tredgold; Eaton Hodgkinson, F.R.S.; Edwin Clark (on the Britannia and Conway Tubular Bridge); Robert Mallet (on the Physical Principles involved in the Construction of Artillery); Arthur Morin; David Kirkaldy; Knut Styffe, translated by C. P. Sandberg; Macquorn Rankine (Applied Mechanics, and Manual of Civil Engineering); various papers in the transactions of the Royal Society, of the British Association, and of the Institution of Civil Engineers. So that this hand book is founded on an ample basis, and is very comprehensive and complete, as such a basis would lead one to expect.

The following judicious remarks on the merits and demerits of hot-blast and cold-blast in iron manufacture are so judicious that we cannot refrain from quoting them:—"It is often asserted that the hot blast tends to deteriorate the quality of the iron, and it is undeniable that hot blast iron is generally of inferior quality to cold-blast; but this is probably due, not to the effect of the process itself, but to the facility it has given for working inferior ores, cinder heaps, and other materials of a worse character, and so for turning upon the market a class of iron which under the old system could not have been made. There is no doubt that the hot-blast process has much increased and cheapened iron production, and therefore has been a benefit to the iron manufacture."

The book contains some illustrative wood cuts.

Railways or no Railways: Narrow Gauge Economy with Efficiency *v.* Broad Gauge Costliness with Extravagance. By ROBERT F. FAIRLIE. London: Effingham Wilson, Royal Exchange. 1872.

MR. FAIRLIE, like all inventors, is disposed to do what in the vernacular slang of the day is called "go the whole hog." His extreme narrow gauge is *the one* which ought to be adopted in all places. He cannot be content with allowing it to stand as a system which may be useful (and we think it is) in some countries and under some circumstances. Now we can see that its general introduction in this country would produce break of gauge and many other inconveniences, and hence cannot enlist under Mr. Fairlie's banner as thoroughgoing partisans. At the same time we can well understand that there are parts of this country where the extreme narrow gauge may be usefully applied, and that in our colonies and in many foreign countries it might be adopted with advantage.

The views and arguments which Mr. Fairlie very cogently puts forth in this book will, perhaps, be best understood by our quoting from his "Introduction," where he says:—

The rapidity with which railways on a narrower gauge than that of 4 ft. 8½ in. are now being constructed in the United States, and in other parts of the world, is regarded with many misgivings by a large number of engineers, who imagine that they see in this departure from an orthodox practice the establishment of a system that shall be of comparatively little service, that will entail loss, direct and indirect, and that the progress of civilisation and the development of wealth, which the construction of railways has hitherto so vastly promoted, will be retarded, if not stayed, where lines of 3 ft. or 3 ft. 6 in. shall supersede those broader roads in the belief of which they have been educated. In short, engineers of this class maintain that because a width of 4 ft. 8½ in. has been hitherto made the standard, that therefore a reduction of this width can only give efficiency diminished in proportion as the rails approach each other, while the actual outlay for first construction is but slightly affected, and the subsequent cost of working and of maintenance remain unaltered. It is only a short time since Mr. Hawksley, the President of the Institution of Civil Engineers, remarked in the course of an address delivered on the occasion of his election to the presidential chair (the highest professional honour the Institution can bestow) that a new gauge of absurd dimensions (3 ft. 3⅜ in.) had been introduced into India, at the instance of some unknown crotchety person, to inflict upon the country all the evils of break of gauge and all the inconveniences of an inefficient railway accommodation, when there already existed a magnificent railway system which when completed would fulfil every requirement.

Unfortunately for India her railways have been made too magnificent, and the comparatively short mileage now constructed has been built at a stupendous outlay to accommodate a very small traffic. And this same remark holds good in Australia, where the advocates of broad gauge are straining every effort to extend the ruinous system with which the country is already burdened. But in England authoritative opinion against the introduction of the narrow gauge and its necessary adjuncts is not so much expressed as implied; argument gives place to action, powerful in checking true railway progress, and other motives are too often apparent in the course taken to achieve this end.

In the United States, on the other hand, the case is widely different; opinion finds free vent among the members of the profession, and with the greatest earnestness, and with much ability, the merits of both sides of the case have been universally discussed, while thousands of miles of narrow gauge line have been commenced, which when completed will practically and thoroughly decide the now much-vexed question. To this characteristic energy (it is scarcely two years since I had the pleasure of advising upon the details of the first great narrow gauge railway with the directors of the undertaking) the world will owe a debt of gratitude, and the great problem of railway progress will have been solved years earlier than if it had been left in the hands of the more prejudiced and less progressive engineers of this country.

Interested as I am in the matter of narrow gauge railways, for I have during many years devoted my best energies—with no small success—to proving the numerous and great advantages to be derived from their adoption, I gladly take advantage of the opportunity afforded me in the document recently published by the Hon. Silas Seymour, of New York, upon the question of narrow gauge railways, in answer to a report prepared by General C. P. Buell, chief engineer of the Texas Pacific

Railroad, in which he advocated the adoption of a 3 ft. 6 in. gauge. This report was submitted by Marshall O. Roberts, Esq., president of this railroad, to Mr. Seymour for an opinion, as the board of directors did not feel justified in assuming unadvised the responsibility of adopting a narrow gauge for a great trunk line 1500 miles in length.

In his reply Mr. Seymour has taken much pains to prove the fallacy of the arguments in favour of narrow gauge, and is apparently desirous of treating the subject with the utmost justice; but, unfortunately, he has not taken the trouble to make himself acquainted with existing experience, and treats the whole question theoretically. Had he made use of information lying ready to his hand it is probable that his pamphlet would never have been written; certainly it would have been vastly modified, and he would have been enabled to touch the vital points of the question, which he has now failed to do.

But as his "Review" may be regarded as representative, expressing the opinions of narrow gauge antagonists, I have thought it well to analyse, paragraph by paragraph, the whole of Mr. Seymour's arguments, and to prevent any confusion I have quoted them in their proper order, and appended my own comments.

With these few remarks [illegible] I place my reply to Mr Sey[illegible] "Review" before the public, who must judge [illegible], and I beg them to bear in mind the following extract which I have [illegible] from the appendix to his pamphlet [illegible] ... "The question [illegible] decided therefore [illegible] proper width of gauge to be adopted on any given line of railway is not whether a gauge of 6 ft possesses greater capacity than a gauge of 4 ft. 8½ in., but rather *what width of gauge is the best adapted to admit of such a construction of machine as will most profitably overcome the resistance of the line, and that will meet the nature and extent of traffic, present and prospective.*"

An Introduction to the Practical and Theoretical Study of Nautical Surveying.

By John Knox Laughton, M.A., F.R.A.S., F.R.G.S., Mathematical and Naval Instructor at the Royal Naval College. London: Longmans, Green, and Co. 1872.

This is another and a very valuable addition to the works on technical and technical education, now issuing from the press of this country, its object being to impart such a knowledge of principles and [illegible] such guidance for the practice of surveying, as will enable the young officer to readily to arrive at the [illegible] a mastery of the [illegible] enable others [illegible] and intelligently [illegible] surveyor's work. But some [illegible] interest [illegible] value, as well as [illegible] many refinements of correction [illegible] which, neat as they may [illegible] of very little practical [illegible] purposely omitted. Great stress [illegible] of observations with the sextant, to the comparative exclusion of the theodolite [illegible] that the sextant [illegible] instrument more likely to be in the hands of a young officer, and one which he ought to have a perfect mastery of. The astronomical observations of a survey, the determination of positions afloat, must be made with it; the observations on shore connected with the triangulation and the determination of secondary [illegible] may be made with it, in short, a complete survey may be carried on with the sextant alone, but not with the theodolite, and, besides, anyone who can really use the sextant will learn the ready and familiar use of the theodolite in a short time. The author states that a very experienced surveying officer has given it as his opinion on this subject, that a young surveyor ought not to be allowed to touch the theodolite till he has proved himself capable of doing all the work in a satisfactory manner with the sextant; and there is little doubt that if he does not attain a perfect use of the sextant for such observations before he begins to use the theodolite he is not likely to do so afterwards.

Much of the matter has been gathered out of various published treatises on the same or kindred subjects; some has been worked out simply on mathematical principles. The assistance the author received from friends in the surveying branch of the service and from the officers of the Hydrographic Department of the Admiralty, and still more from his fellow-worker in the Royal Naval College, Staff-Commander V. F. Johnson, is duly acknowledged.

In the introductory chapter the author defines surveying, and adverts to the specialties of a nautical survey, in the second chapter he treats of observations on shore, in the third, of the construction of charts, the fourth he devotes to observations afloat, and his concluding chapter, the fifth, is devoted to running surveys.

Principles of Geology;

or the Modern Changes of the Earth and its Inhabitants Considered as Illustrative of Geology. By Sir Charles Lyell, Bart., &c. Eleventh and entirely revised edition. In two vols. Vol II., illustrated with maps, plates, and woodcuts. London: John Murray, Albemarle Street. 1872.

In the present volume of this new edition of the above valuable work fresh information has been introduced as to New Zealand Geysers, and reference is made to Dr Tyndall's illustration of the probable mode of Geyser action (pp. 219–223). Mr Scrope's view published in 1871 on the action of water in volcanoes (p. 226) are considered, as are the opinions of Sir John Herschel and Mr Babbage (p. 241) on transfer of sediment causing the shifting of the subterranean isothermals, so are Mr Wallace's views on the single origin of the dogs (p. 294), and the Rev. R. T. Lowe's [illegible] account of the arrival of a flight of locusts in Madeira is noticed. As might be expected special [illegible] is accorded to Mr Darwin's views as to sexual selection (p. 328), and [illegible] to cases of abnormal structure in pre-historic man corresponding to the structure of the same parts in some lower groups of animals (p. 484), also to Mr. Mivart's objections to the theory of natural selection, and Mr Darwin's reply (p. 497). The volume also contains a dissertation on the temperatures and fauna of Lake Superior (p. 576), also the depth to which the ocean is inhabited, as illustrated by deep sea dredgings, and the amount of difference of the oceanic fauna in adjoining warm and cold areas. These additions make this well esteemed work still more worthy of commendation.

Life of Richard Trevithick;

with an account of his Inventions. By Francis Trevithick, C.E. Illustrated with engravings on wood by W. J. Welch. Vols. I. & II. London: E. & F. N. Spon, 48, Charing Cross. New York, 446, Broome Street. 1872. [*First Notice.*]

Want of space prevents our being able in the present notice of this very pleasant and highly instructive work to do more than state our favourable opinion of it. We shall take an early opportunity of presenting our readers with some extracts from its pages.

Technical Education and the Mansion House Committee.—A programme has been issued by this committee suggesting the establishment of Lectureships at Gresham College, London Institution, &c. Premiums or Prizes for Artizans to Schools willing to give Education in Technical Art or Manufacture; Public Exhibitions of Articles manufactured by Artizans with Money Prizes of considerable value open for competition; Premiums for Scientific Construction; Inducements to be offered to Masters and their Workmen to take Apprentices.

The British Association.

(*Continued from page 139.*)

Mr. Finlay made some observations on the subject of the levels, and asked whether Dr. Livingstone had used aneroid barometers or mercurial barometers.

Mr. Stanley expressed his thanks to Sir H. Rawlinson and Mr. Oswell for their complimentary references to himself, and then proceeded to say: Captain Grant states that there is a discrepancy between Dr. Livingstone's and Captain Speke's statements. I don't see that there is any at all. The Nyanza has nothing to do with the Lualaba. That is proved, for between them exists the great Lake Tanganyika. It was objected that there were no gorillas in the country near the lake, but that is no reason why they should not exist in Central Africa. Captain Grant says that Dr. Livingstone has made a mistake about the river Lualaba, but I want to know how a geographer resident in England can say that there is no such river when Dr Livingstone has seen it. (Laughter.) Dr. Beke says that Dr Livingstone has not discovered the sources of the Nile. Dr Livingstone himself says that he thinks he has discovered them, but there is this difference between them, that Dr. Livingstone is encamped by the shores of Lualaba, and thinks that he has discovered the sources of the Nile, and gives reasons for his belief. He says that he has traced this chain of lakes and rivers from 11.8. to 1 S., and Dr Beke, who has never been within 2000 miles of the Lualaba, says that he has not discovered the sources of the Nile. (Cheers.) This was not a question of theory, but of fact. Theory won't settle it, it must be settled by men who, like Dr. Livingstone, have fought and laboured for thirty five years at the task. I think that Dr. Livingstone has discovered the sources of the Nile, and that he has good grounds for his belief, and I am quite sure that, when he returns two years hence, and says, "I have discovered the sources of the Nile," there will not be one recalcitrant voice saying, "You did not." (Cheers.) Dr. Beke further says the mountains close up, and a river interposes, which prevent the Lualaba flowing into the Bahr-el-Gazal. Now, in my belief, there is nothing whatever impossible in the Lualaba flowing into the Bahr-el-Gazal, seeing the great bends which the latter river makes. It runs west a distance of four degrees. It then runs south west, next north, and then east. As it proceeds it receives several rivers flowing from east to west, and from the west to the east. If the Nile has not been discovered, what, let me ask, has been discovered? (Laughter and cheers.) What is that great and mighty river the Lualaba? Where does it go to? Does it go into a lake as Sir Henry Rawlinson supposes? What, the Lualaba flow into a lake or into a marsh into a swamp! (Laughter.) Why you might just as well say that the Mississippi flows into a swamp. (Laughter and cheers.) All the rivers flowing into the Tanganyika are nothing whatever compared with the Lualaba, which at some places is from three to five miles broad. If the Lualaba enters a swamp, where does all the water go? (Cheers.) No native ever told Livingstone that the Lualaba went west. On the contrary, they all said that it ran north, and yet a German geographer comes forward and says he saw a little river. He may have done so, but that does not prevent the Lualaba from being a big river. (Laughter.) I never yet heard of an Englishman who had discovered anything but a Herr of some sort came forward and said he had been there before. (Loud laughter.) Do you mean to tell me that Dr Livingstone has spent six years searching for the sources of the Congo? Not a bit of it. What he wants is to find out the sources of the Nile. The sources of the Congo may go where they like, so far as he is concerned. I have not the slightest doubt that he will yet come home with the true sources of the Nile. (Loud cheers.) These

gentlemen have not asked a single question which I have not asked of Dr. Livingstone. I asked him if he had discovered the source of the Nile at 2000 feet above the sea, and how he could account for the discrepancy as to the degrees of latitude which have been mentioned. "Well," he said, "that is what baulks me." (Laughter.) But still he adhered to his opinion, and you must recollect that he has arrived at it with hesitation and humility, after six years' travel and hard work; also that his thermometers, barometers, and other instruments, which were new when he started, may now be in error. Discrepancies that may now seem to exist may hereafter be cleared up. Theory and practice must fight. Which will win, do you think? I think fact. I think practice. I think if a man goes there and says, "I have seen the source of the river," the man sitting in his easy-chair or lying in bed cannot dispute the fact on any ground of theory. (Hear, hear.) The best way is to go there and disprove Dr. Livingstone. Dr. Schweinfurth may be right, and Dr. Livingstone may be right. We cannot now solve the problem. You must go there and disprove what Dr. Livingstone has said for yourself, or else listen to and believe those who have been there. (Cheers.)

Mr. Hall said that Dr. Livingstone had arbitrarily fixed the source of the Nile at between ten and twelve degrees of south latitude, and he wished to ask Mr. Stanley how he reconciled that with the facts he himself, as well as Dr. Livingstone and other gentlemen, had stated as to the large river system in that part of Central Africa.

Mr. Stanley confessed that he did not see any discrepancy. Dr. Livingstone had simply followed the river to its source, and what could he do more? (Laughter.)

Mr. Hall persevered with his questions amidst some impatience on the part of the audience, and, Mr. Stanley having humorously responded, he reluctantly retired from an unequal contest.

The President said they had all seen and admired Mr. Stanley's passionate appeal on behalf of his absent friend, Dr. Livingstone, but they must all be careful not to fall into the error of thinking that because a man had not been in a country he therefore knew nothing about it. (Hear, hear.) The gentlemen who had spoken were one and all really very competent to give an opinion on the subject, which really was one as much a matter of theory as anything could be. It was, no doubt, a fault of travellers that they were too little aware of the amount of knowledge which had been derived from other sources on the matters of which they were inclined to speak. If he might be allowed to express an opinion he should concur with Dr. Beke, that, if the centre of the Lualaba is only 2000 feet high, it was hardly possible to see how it could continue in the same level as the Gondokoro. He could not agree with the President of the Royal Geographical Society that it might flow into a large central, and therefore tropical lake. He could only express his regret that the excellent instruments sent out to Dr. Livingstone had not reached him, for it was abundantly evident that the instruments he had were quite inadequate. There was another point they must not forget. Dr. Livingstone was not yet out of the bush. (Hear, hear.) Nothing had yet been heard of the party sent up by Mr. Stanley since they had left the coast. Of the relief fund so liberally subscribed there still remained £3000, which, if need arose in the course of years, they would be ever ready to apply. (Cheers.)

19th August.

MATHEMATICAL AND PHYSICAL SCIENCE.—Four papers were read by Mr. Glashier, jun., namely, "Report on Mathematical Tables," "On the Law of Distribution of Prime Numbers," a function standing in Bernoulli's experience, the relation that the Gamma function may be useful factorials," and "On the Evaluation of an Integral in series," and may placing before of information by competent be every one of them mathematically of much value and importance, for Mr. Glasher, jun., is a first-class man of very high promise, and a senior wrangler. And so may be equally valuable Mr. Hilyard's paper "On a verification of the probability function;" Prof. Hermite's "On the elimination of arbitrary functions;" Prof. Smith's "On the circular transformation of Mobius," and Prof. Clifford's "On the contact of surfaces of the second order with other surfaces;" as also Mr Russell's interminable "Reports on hyper-elliptic functions," *et omne genus*; but there is no popularity to be gained for science by such means, and there has become general a feeling of regret that physical science has of late years so much fallen behind in Section A, and that the halls which used to be filled with brilliant audiences by the attractive essays of those eminent physicists and astronomers who are no longer seen at these gatherings, should now present not unfrequently empty benches in front of a platform upon which the mathematicians read their solutions to one another, and chalk their formulæ on the blackboard for mutual edification. No one would wish to find fault with the mathematicians for having their own quiet Saturday, nor to deprive them of it, but once in the week is surely enough for pure mathematics, and if physics be longer neglected it will be obvious that the constitution of this section will need an infusion of new blood to make it as it used to be, the most brilliant and attractive of all the scientific arenas. Taking stock, however, of the proceedings of this section, so far it has performed a considerable amount of good work, although in a very quiet way. The report of Mr Lockyer and Dr. Thomson "On the Eclipse Expedition of December 18th, 1871" (and towards which, at the request of the Association, the Government granted a sum of £2000), was a welcome contribution, although not so decisive in conclusions as could have been wished, yet the evidence produced of the reality of the radial polarisation of the light from the corona appears sufficient to authorise acceptance of the hypothesis that the corona is a vastly extended appendage of the sun. Mr Glaisher's report on luminous meteors was not less able or less carefully prepared and complete than any of the previous communications which he, Mr Alex. Herschel, and the committee with which he is associated have from year to year produced. A considerable portion of the report was, as usual, devoted to the determination of the radiant points of the meteor-showers. Two aerolites were recorded as having been seen to fall during the past year, one in America and one in France. Other papers of mark were Mr. Warren De la Rue's "Report on Spectral Rays arranged upon a scale of wave numbers," "On the Spectrum of Hydrogen," by Mr. A. Schuster, tending to show that it was probably impurities which caused the hydrogen bands; Mr. Birt's "Report on Lunar Objects suspected of change," in which he continued the record of further researches; and Mr Forbes' paper "On Astronomical Refraction," the purpose of which was to point out sources of error in observations of stars due to variations of moisture in the atmosphere and of barometric pressure. Mr Winter's essay "On the Use of Electro-magnetic instead of Electro-static in Cable Signalling" had the favourable opinion of the chairman of the section, Professor Foster, but elicited no discussion whatever. The other papers not already noticed in our columns which have been read in Section A are "On Double-Neutral Points in Thermo-Electric Circuits," and "On Sympathy of Pendulums," by Professor Tait; "On the Mitoscope and a new Spiral Top," and "On the Tangential Balance and a new Saccharometer," by Professor Zenger; "On the relations between the Gaseous, the Liquid, and the Solid States of Matter," and "On Atmospheric Refraction of Inclined Rays," by Professor James Thompson; "On Mirage," by Professor Everett; "On a Nautical Photometer," and "On the Stresses Produced by Inequality of Temperature," by Dr. J. Hopkinson; "On the Action of Sunlight on Colourless and Coloured Glass," by Mr. Gaffield; and "On Refraction and Solar Spots," by Mr. J. H. Brown.

CHEMICAL.—Eighteen papers have been read in this section up to this date, of which the following are the titles of those not hitherto noticed in our report:—"Report of the Committee for Investigating the Chemical Constitution and Optical Properties of Essential Oils used for Perfumes," "On the Fusion of Metallic Arsenic," and "On the Effect upon Meteoric Iron, as regards the capacity of being forged, of being previously heated to redness or whiteness in vacuo," illustrated by a paper-knife forged from a piece of metal cut from the original mass by a planing machine, and by another piece cut from the same mass, which after heating to whiteness could not be forged at all—by Professor Mallett, of Virginia, U.S.; "On a Curve illustrating the Purity of the British Gold Coinage," by Mr. Chandler Roberts, chemist to the Mint—the results of the assays, as indicated by the curve, proving the divergence in the amount of gold from the absolute standard prescribed by law to be very slight indeed; "On the Mode of Collecting Samples of Deep Sea Water, and their Analysis for Dissolved Gaseous Constituents," by Mr. W. L. Carpenter (son of the President of the Congress), introduced by the author with a view to discussion on the best kind of apparatus to be employed; "On a New Filter Pump," by Mr. T. E. Thorpe; "On the Tube Ozonometer," by Dr. Moffat; "On a Modification of Hofmann's Apparatus for the Electrolysis of Water," by Mr. C. J. Woodward; "Preliminary Report of the Committee on Siemens' Electrical Resistance Pyrometer"; "Report of the Committee for Superintending the Monthly Reports of the Progress of Chemistry"; "On the Mutual Helpfulness of Chemical Affinity, Electricity, and Heat in the Decomposition of Water," by Dr. Gladstone and Mr. Tribe; "On the Precipitation of Silver on Copper," by Mr Tribe; "On the occurrence of Native Sulphuric Acid in Texas," and "On the occurrence in recent pine-timber of Fichtelite—a hydro-carbon hitherto only known in a fossil state," by Professor J. W. Mallett; "On the manufacture of Chlorine by Manganate of Magnesium," by Mr. W. Weldon; "On the Composition of Bleaching Powder," by Mr. C. Calvert; and "On the Dust thrown up by Vesuvius in the Recent Eruption," by Mr. G. Gladstone.

GEOLOGICAL.—The papers read in this section up to this date are:—"On the Brighton Cliff Formation"—the Coombe rock or elephant bed mentioned in the works of the late Dr. Mantell—and "On the Super-cretaceous Formation in the Neighbourhood of Brighton," by Mr. James Howell; "On the Raised Beach of the North east of Ireland," by Professor E. Hull, F.R.S.; "On the Geological Distribution of Goitre in England," by M. Lebour; "On the Temperature and other Physical Conditions of Inland Seas considered in reference to Geology," by Dr. Carpenter, the President of the Congress, in which he brought to bear upon the distribution of geological fauna those views, the results of his recent dredgings and soundings in the Atlantic, which have some time since been made public by his papers and lectures at the Royal and Geographical Societies and the Royal Institution; "On the Occurrence of a Fossil Zeuglodon at Barton, Hampshire," by Mr. Seely; "On the Divisions of the Chalk in France, their limits and their faunæ, and the identity of the divisions on both sides of the Straits," by Professor Hébert; "On the Geology of Thunder Bay and Shabendowan Mining District on Lake Superior," and "On Ortonia," a new genus of fossil tubular worms, by Professor Nicholson; and "On the Trachyte Porphyry of Antrim and Down, Ireland," by Professor Hull. The Geological Section has further made an admirable innovation in the pages of the journal issued to members by putting in an announcement on Friday that at half-past

these, on the termination of the day's session, a visit would be made to the Raised Beach and Elephant Bed at Kemp Town, thus giving such ready and general intelligence that made their extemporised excursion a veritable success.

BIOLOGY AND ANTHROPOLOGY.—Amongst the best papers produced we may note that "On Some Evidence Suggestive of a Common Migration from the East shown by Archaic Remains in America and Britain," by Mr. J. S. Phené. The most important papers, however, so far were those produced on Saturday by Mr. Boyd-Dawkins and Mr. Tiddeman, "On the Victoria Cave," explored by the Settle Committee; and by Sir Walter Elliot, "On the Primitive Weapons of Ancient India." Fifteen papers have been read in this sub-section of D, of which the following have yet to be noted:—"Exploration of Tumuli on Dartmoor," by Mr. C. Spence Bate; "On Bone and other Implements from Caves of Perigord," by Professor Rupert Jones. "On the Discovery of a Flint Implement Station in Wishmoor Bottom, near Sandhurst," by Dr. King; two papers, "On the Etymology of Geographical names in Sussex," and "On the Gipsy Dialect called Sim," by Mr. Charnock; "On the Origin of Serpent Worship," by Mr Staniland Wake; "On the Ethnological and Philological Relations of the Caucasus," by Dr. Hyde Clarke; "On the Predominating Danish Aspect of the Local Nomenclature in Cleveland, Yorkshire," by the Rev. J. C. Atkinson, and "On Stone Implements and Fragments of Pottery from Canada," and "On a Patoo-patoo from New Zealand," by Sir D. Gibb

All the sectional meetings except the mathematical closed at noon for the excursions, which were both numerous and agreeable, and public as well as private, all being pleasant and successful There was one through the flat meadows, watered and kept verdant by the Ouse, to Glynde, where the right Hon. H. Brand, the Speaker of the House of Commons, entertained 100 of the party at his residence There was another by carriages also to Firle, the Viscount Gage entertaining 50 of the visitors. Old and interesting Lewes had a large party by train, who there found, after visiting the ivy-clad ruins of its ancient priory, its castle, and the Norman Church of the Warrennes, conveyances ready to take them on to Stanmer Park, where a right hospitable welcome was offered to 90 guests by the Earl of Chichester, the lord lieutenant of the county. Another party of 50 went to Worthy, and thence to Cessbury and Findon, Mr. H. Willett entertaining; and another excursion party of 100 had luncheon provided for them at Steyning after a visit *en route* to Bramber. There were further extemporised and private expeditions to the Isle of Wight, to Portsmouth, Pevensey, and lastly to that wonderful ancient trench, "The Devil's Dyke," only some few miles from Brighton, and whence the noted view "over six counties" well repays the journey. The new Aquarium was also in demand by the members and associates, and in the afternoon was visited by the Emperor Napoleon and the Prince Imperial.

The lecture given to the working men by Mr. Spottiswoode was, so far as the matter of the lecture and the admirable illustrations by the electric light and his unrivalled polariscope are concerned, of high philosophical order, and so far as the audience is concerned a success of the best augury. The vast space under the dome was filled to overflowing, near upon 4000 were seated within its area and galleries, whilst upwards of 600 are stated to have been refused admission. The subject was "Sunshine, Sea, and Sky," and was most ably treated, but in too much of a drawing-room and philosophical style, and not so simply as evidently was desirable for an audience of intelligent and most orderly mechanics and their families. The Baroness Burdett-Coutts was loudly cheered on her appearance on the front row of the platform. The lecturer at the close of his address was fully applauded; a vote of thanks being proposed by Mr. Thompson, a working tinsmith, in a speech more than creditable, and which was seconded by Mr. Warren de la Rue.

The chief devotional service yesterday was at the parish church of St. Nicholas, when the Right. Rev. the Lord Bishop of Chichester preached an eloquent sermon on the occasion—it being that of the opening of the new grand organ also—from the text Psalm xcii., 1 to 4, "It is a good thing to give thanks unto the Lord, and to sing praises unto His name."

19th August.

MATHEMATICS AND PHYSICS.—Sir William Thomson gave a very able verbal report upon the subject of the tides, which for some years past has been continuously referred to a special committee, and in respect to which Government aid has recently been sought and refused. The variations of the tides and the remarkable phenomena associated with their conditions, as influenced by natural laws and locally by conditions of the proximate land, with the philosophical principles for the estimation of their particular circumstances at particular places, was ably dealt with; whilst the hope was expressed that a tidal department might be added to the Hydrographic Department of the Admiralty, by which full investigation would be made of the tidal theories and predictions tested. The establishment of oceanic stations was looked upon as most important in enabling scientific observations to be made free from the interferences produced by the contiguity of land, and as offering conditions under which the great general movements of the body of the ocean water in the formation of true tides could be properly studied. The Indian Government had done something in this direction by instituting tidal gauges in places less subject to disturbing influences than at present any other establishments were subject to, but these were not sufficient, and it was hoped that a station might be established at the Andaman Islands It was thought that at least the Admiralty might keep accurate time tables of their own ports.

The suggestion having been made that the Circumnavigation Committee might give assistance in this research, Dr. Carpenter, the President of the Association, who was present, said that he was sure every attention to the wish would be paid by Professor Wyville Thomson, in charge of the expedition, and Captain Nares, the officer of the ship appointed, undertaking himself to bring the matter before them.

This communication was followed by the report of the Committee on Underground Temperature, a subject still in its infancy of investigation, but nevertheless one of those of highest scientific interest at present drawing the attention of the Association as a specific object of research. The principal new facts are given by Professor Everitt in this compiled report, including his own and other researches communicated.—

"Messrs. Mauget and Lippmann, who are sinking, for the Municipality of Paris, an Artesian well of unparalleled dimensions at La Chapelle, St. Denis, have kindly supplied observations, taken twice over, with a thermometer supplied by the committee The well is at present 662 metres deep, and has a diameter of 1·35 metre at this depth. It is expected that its depth when finished will be about 2300 feet. All of it except the first 139 metres is in the chalk, and needs no tubing. The surface of the ground is 48 metres above sea level, and the water in the central tube stands at 16¼ metres below the surface of the ground. An interruption occurred in the boring on June 12. The boring tool was lifted out of the well at that date, and was not introduced again till after the observations had been taken. The observations give the temperatures at every hundredth metre from the surface of the ground, and also at the depth of 660 metres; and the temperature observed in the second trial, July 17th and 18th, agree almost precisely with those observed in the first trial, July 14th and 15th, although the thermometer was left in the water for two hours each time at the second trial and only for half an hour at the first trial. The increase of temperature is tolerably regular, except for the last 60 metres, where it is about four times more rapid. Messrs Mauget and Lippmann attribute this anomaly to the heat generated in boring, and mention that the mud brought up in the boring tool has usually a temperature of from 118 deg. to 191 deg Fahrenheit on coming to the surface, notwithstanding the cooling action of the water in hauling it up; but if this is the true explanation it is somewhat remarkable that the temperature at the depth of 660 metres was precisely the same at the second trial as at the first, although an interval of three days occurred between them. The temperature observed at 600 metres, compared with that at 100 metres, gives an average increase of 1 deg Fahrenheit in 94 2 feet; and the temperature observed at 660 metres, compared with that at 100 metres, gives an average of 1 deg Fahrenheit in 72 5 feet These three temperatures are, in fact, 58 deg, 75 4 deg., and 83 25 deg. Fahrenheit Additional observations from the same well are promised. Mr G. A. Lebour, F G S, and Mr. Atkinson, student in the Newcastle College of Physical Science, have furnished observations made in a bore 2¼ inches in diameter and 863 feet deep, executed from the bottom of the shaft of South Hetton Colliery, which is itself 1066 feet deep, giving a total depth of 1929 feet. The bore was dry when executed three years ago, but has since become filled with water entering it from the shaft The thermometer could not be lowered to the bottom (855 feet), on account of mud, the lowest depth reached was 670 feet, and at this depth, the thermometer being 30 feet deep in mud, the temperature was 77 deg 1 min. the temperature of 100 feet being 66 deg. The comparison of these two observations gives an increase of 1 deg in 51·2 feet, and if the temperature at 60 feet from the surface of the ground is 48 deg, as assumed by Mr. Lebour, the average increase over the whole distance is 1 deg in 57 5 feet. Thermometers have been sent to Australia for observations in the gold mines, under the direction of the School of Mines at Ballarat. Also to the Smithsonian Institution, for observations in the Hoosac Tunnel, which will be 4¾ miles long, and passes under two ridges whose heights are respectively 1720 and 1420 feet. Also to Moscow and St. Petersburg, at the request of Professor Lubimoff and Dr. Wild. A thermometer has also been furnished to the committee of the Sub Wealden Exploration."

GENERAL COMMITTEE Belfast was the place selected for 1874, and Dr Joule is the President at Bradford next autumn Deputations were also present from Glasgow, from Bristol, and from Bath, the two former competing for 1875 and the latter asking for an early date. The gathering at Bradford was, in accordance with the wish conveyed by the mayor of that town, fixed for the 19th September

The following items bring up our report of the proceedings of the Association to 17th August.—

SUB-SECTION FOR ANATOMY AND PHYSIOLOGY.—Professor Burdon Sanderson, President, in his inaugural address, said: "I should have been glad if it had been possible to have given a retrospective account of the progress of physiological research during the past year. I had intended to do so, but was led to abandon my intention on the ground that although the work done has not been inconsiderable, we in England have taken very little part in it, If I had been attempting the task I should have been but chronicling the achievements of our friends in Germany who are now holding their own scientific assembly in Leipsic." Professor Sanderson ascribes the main progress for the last twenty years of this branch of science to other than Englishmen, but we must for our own part doubt whether book reading and estimation by public papers do after all

give a true or just view of the actual progress made by men of a nation so practical as ours. We have often heard the like stated for foreign manufactures and for machinery by men regarded as eminent for their philosophical studies, but have been happily able to disprove those statements by careful scrutiny and close examination and comparison. The papers read in this section have, however, certainly been mostly of a special character, of more or less isolated nature, as well as scanty in number. On Thursday and Saturday the department did not sit, and on Friday the following papers only were offered:—"On the Heat of Arterialisation," by Dr. Gamgee; "On the Arrangement of the Lobes of the Liver," by Professor Flower; "On the Occurrence of the Supracondyloid Process in Man," "On the Sternum and Pelvic Bones in the Right Whale and in Great Fin Whales," and "On the Occurrence of Finger-muscles in the Bottle-nose Whale," by Professor Struthers; "On the Graft Theory of Disease," by Dr. Ross; "On the Concurrent Contemporaneous Progress of Renovation and Waste in Animated Frames,' by Mr. Geo. Harris; and "On the Mechanism of Muscular Contraction," by Dr. Radcliffe.

SUB-SECTION FOR ZOOLOGY AND BOTANY, under the presidency of Sir John Lubbock, has dealt with the following subjects:—"The Fourth Report on the Marine Farina of South Devon," by Mr. Spence Bate; "The Second Supplemental Report on the Extinct Birds of the Mascareen Islands," by Professor Newton; "Report on Zoological Stations," by Dr. Dohrn; "On the Perforating Instruments of Pholas Candida," by Mr. J. Robertson; "On a New Asiatic Rhinoceros," by Dr. Sclater; "On the Mollusca of Europe, compared with those of Eastern North America," by Mr. J. Gwyn Jeffreys; "On Deep Sea Dredging round the Island of Anticosti," by Mr. Whiteaves; "On Dredging in Lake Ontario," by Professor Nicholson; "On the Structure of Mitraria," by Professor Allman; "On the Botany of Moab," by Mr. Hayne; "Report of the Close Time Committee," by Mr. Dresser; "On the Dentition of Macrauchenia," by M. Paul Gervais; and "On the Whales of the Antwerp Crag," by Professor Van Beneden.

GEOGRAPHICAL.—Several matters of much interest have been under the consideration of this section, including an essay "On the Explanation of the Moabite Country," by the Rev. Dr. Ginsburg and by the Rev. Canon Tristram. The following is a brief recapitulation of the latter. The first feature which strikes the geological observer of the shores of the Dead Sea is the remarkable contrast between the eastern and the western sides of the lake. On the western side we find nothing but vast marl deposits, utterly unfossiliferous, and of modern origin, fringing the foot of a precipitous limestone range of eocene character. Only two or three springs occur for a space of nearly fifty miles. On the east side, on the contrary, with one partial exception, that of the Lisan, or marl peninsula, the sea is fringed with a rich belt of vegetation, and the gorges which in rapid succession descend to the sea are well wooded with palm, tamarind, and other trees, with perennial streams, while the whole coast is studded with copious springs, some hot and others cold, many strongly sulphurous, but most of sweet water. On examining the range, which descends precipitously 3000 feet to the shore we find its average height 800 feet higher than the western range, and though its upper portion is coarse limestone, with the same fossils, chiefly gryphœus, as the western, yet for about 600 feet immediately above the shore we find exposed the underlying new red sandstone. In the superincumbent limestone there appear to be few, if any, springs, and the ruins yield evidence that the former inhabitants of the uplands depended entirely upon wells of drainage water, tanks, and cisterns. But up all the ravines at this junction of the limestone and red sandstone springs are most abundant. This red sandstone never appears on the west side of the Jordan valley. In

(Continued on page 150.)

NEW RAILWAY-CARRIAGE VENTILATOR.

AN effective means of ventilating railway and other carriages has long been wanted, but hitherto nothing has been provided which has fully met the necessities of the case. The present invention we are disposed to consider will prove satisfactorily effectual. The great feature in this invention is a cap which is so constructed that "ingress" to wind and rain is wholly prevented. It rotates without noise, and by a mechanical arrangement creates an upward current which carries away all impure gases as they are generated; obviating the necessity of opening windows of carriages in cold, damp weather when relief is sought for from oppressive and offensive atmosphere, now the only alternative; a proceeding than which, however, nothing is more destructive of comfort or dangerous to health.

This ventilator can be fixed upon railway carriages without [illegible] ments [illegible] disturbing present arrangements, and, being placed over the lamps, supplies them with air, so that their illuminating power is maintained whatever may be the state of the weather.

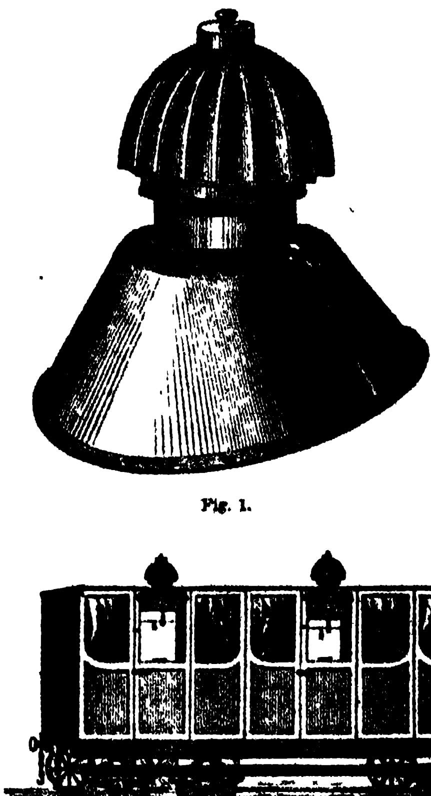

Fig. 1.

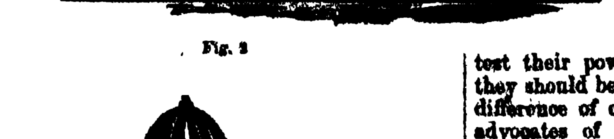

Fig. 2

Fig. 3.

The engravings show—Fig. 1, the ventilator affixed to her Majesty's saloon carriage on the London and North-Western Railway; Fig. 2, ventilator as it appears on the carriages; Fig. 3 shows the opening to admit the lamp from the roof—the cap moving on a pivot covers the orifice and fastens with a spring-catch as shown. The inventor of this ventilator is Mr. J. Sabberton; and the agents are Messrs. Adutt, Finzi, & Co., 24, Mark Lane, London, E.C.

SHIPS' LIFEBOATS.

SOME interesting experiments were recently made upon the water of the Regent's Canal Dock, Limehouse, in the trial of selected ships' boats competing for the gold medals of the Society of Arts in regard to life-saving qualities combined with the ordinary qualities of ships' boats. The committee under whom the experiments are being carried out comprise, among others, Lord Henry Lennox, M.P., Admiral Sir Edward Belcher, Mr. Goschen, M.P., Captain Nesbitt, Admiral Ommanney, C.B., Mr. E. J. Reed, C. B., Admiral Ryder, C.B., Mr. Seymour Teulon, Captain Ward, and Captain H. Tyler, many of whom were present, and there were also present General Eardley Wilmot, Mr. P. Le Neve Foster, and a great number of shipowners. The gold medals had been offered for a ship's lifeboat suitable for the mercantile marine, and plans or models were to be made combining these requirements—"buoyancy sufficient to insure that the boat be manageable when, in addition to the number of persons and additional dead weight (if any) she is intended to carry, she is filled by a sea; the fittings or appliances by which such buoyancy is obtained to remain efficient under all circumstance of climate and temperature, as well as under exposure to sun, weather, and salt water; fitness for ordinary use as a ship's boat; strength, durability, lateral stability, or resistance to upsetting on the broadside; relief of water to the outside level, cheapness, simplicity of structure, lightness." There were 44 models and six drawings sent in to compete, one competitor sending in 19 models. After an examination the committee rejected three classes—"boat rafts," as unsuited for ships' boats; decked boats for the same reason; and all boats depending upon cork for their "extra buoyancy"; all sliding keels. Excluding all these, the remaining competitors were requested to supply actual boats for actual testing. The makers of the exhibited boats were—Messrs. Woolfe and Sons, who presented two boats, the one a 20 ft. boat, for coasters, the other a 25 ft. for general merchantmen; Messrs. Hamilton and Co., of Liverpool, who offered two boats, both of iron, on Francis's corrugated principle; one by Captain Nesbitt, of the Trinity House; and another by Mr. White, of Cowes. The last-mentioned was a 20 ft. boat. Each of the boats in turn was tried in a variety of ways. In the large boats 28 men were placed, and in the small ones 20, a quantity of water up to the seats being already in, and the men rolled about first on one side then on the other to test the stability. Then the boats were tried in the way of being turned keel upwards to test their powers of righting themselves if they should be thus turned. There was much difference of opinion, of course, between the advocates of the iron ship's boat and the wooden ship's boat, the advocates of the latter pointing out that, in case of the damage of an iron boat, the thing was altogether for the time valueless, while the other side pointed out that the iron boat could not warp. The committee present eventually decided that they would confer regarding their report.

CO-OPERATIVE STEAM CULTIVATION.—At a meeting of a steam-ploughing traction engine company, recently held at the Westminster Hotel, Mr. Bass, M.P., said that a steam cultivation company which operated in Derbyshire, Nottinghamshire, and Lincolnshire made a profit of quite 25 per cent. Mr. Henry Yates, the managing partner of the company referred to, writes to a contemporary stating that Mr. Bass is mistaken. During the last three years the profits of the company have been [illegible], 4, and 9 per cent.

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THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON.

ESTABLISHED 1ST MAY, 1862.

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SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868.
LORD RICHARD GROSVENOR, M.P.

Chairman of the Council

SIR ANTONIO BRADY.

SPECIAL NOTICE

A New Session will commence in November and anyone desirous of bringing under discussion at the Meetings of the Institute any question of practical science or improvement should apply to the Secretary without delay. Members are specially invited to make use of this medium of giving publicity to their works of ingenuity.

Members whose subscriptions are now due will please to forward the same to the Collector, Mr. G. A. Stretton, 4, St. Martin's Place, Trafalgar Square, London.

Monthly Notices.

Social Science Association and Law Reform as affecting Inventors.—Tribunal of Commerce.—International Exhibition at Vienna.—London International Exhibition, 1873.—American Exhibitions.—Rubber Bands v. Leather Bands.—French Scientific Literature: Les Mondes, and Revue Hebdomadaire de Chimie.—W. H. Tooth on Mechanical Puddling.

SCIENCE has its seasons like everything else, and the past month is not within its season, excepting always that kind of science known as "social" science, which has been brought prominently before the public by the annual meeting of the Social Science Association, inaugurated, it may be said, by the speech of Sir John Coleridge, the Attorney-General, on behalf of Law Amendment, wherein he strongly urged that codification was the prime requirement. He did not give any particular [illegible] to the amendment of that branch of the law we think ought to receive the first attention of our legislators—the Law of Patents; and perhaps this is of very little consequence, since Sir John evidently does not consider the cheapening of law proceedings as worthy of much notice, though this is in reality the great amendment required in the Patent Law system. Clearly, if we are to have only such law reforms as successful practising lawyers are willing to bestow upon us, they may indeed be considerable as far as regards the symmetrical character of the law (which, considering the unsymmetrical and ever-varying circumstances of life, may effect as much mischief as good), but they will be utterly insignificant for affording to every man cheap and speedy justice. Our advice to inventors and those belonging to our industrial interests is to emancipate themselves from lawyer-thraldom. Probably this might be best effected by the establishment of a good system of Tribunals of Commerce, in which lawyers should only be allowed to be called in occasionally, to give advice if needed, but otherwise should be rigidly excluded from taking any part in its proceedings—a special department of this tribunal to be empowered to deal with Patent cases. A movement in behalf of Tribunals of Commerce is being carried on in the City of London by Mr. J. R. Taylor, of Weavers' Hall, Basinghall Street, which we commend to the attention of our readers.

We are glad to find that the International Exposition of Vienna, 1873, is progressing favourably, and we hope that our manufacturers will make a good show there. These exhibitions are now established as things of the day, and whatever drawbacks they may have must not deter us from making the best we can of them.

The arrangements for the London International Exhibition, 1873, have been issued by Her Majesty's Commissioners. The Exhibition is to commence in April and close in October, 1873. Intending exhibitors should make early application for space.

Whilst speaking of exhibitions we may note that five grand industrial exhibitions have been held in the United States of America—namely, the Industrial Exhibition of the American Institute, at New York; another at Newark, N.J.; another at Baltimore; the Cincinnati Exhibition, and the Grand National Industrial Exhibition, at Louisville, Ky.

Referring to the United States, we may remark that the *Scientific American* has lately been devoting much of its space to the question of the comparative merits of leather and india-rubber as materials for driving bands. We think this is a subject that deserves careful investigation, and commend it to the consideration of our readers.

France is again as active as ever in scientific pursuits. Our old friend *Les Mondes* has just completed its tenth year (vol. 28), and its index shows that a more complete chronicle of the world of science could not be wished for. The list of names of scientific and technical men whose works, whether literary or otherwise, are noticed in its pages, shows that few men of any note have been forgotten. Another French serial, *Revue Hebdomadaire de Chimie*, by M. Ch. Mène, is well worthy of being consulted by those who wish to know what is going on in the chemical department of the world of science.

The Lord Mayor is still holding meetings at the Mansion House of the representatives of the Livery Companies, for the purpose of inducing those bodies to take concerted action for the promotion of technical education. The present position of the matter we reserve for another column.

In addition to the communication from Mr. W. H. Tooth on the subject of cartridges and firearms, we have received one on the subject of mechanical puddling, the insertion of which we are compelled to postpone.

THE BRITISH ASSOCIATION.

(*Continued from page* 118.)

Gilead, to the north-east, I have only found it cropping out in one or two places. Probably it is not more than 200 feet below the surface on the west side of the great rift of the Jordan, and Artesian wells to that depth may yet fertilise the country. I may remark, too, that the stratification of both lower and upper deposits in Moab rapidly dips towards the west, and is synclinal, as it is in all other parts of the Jordan valley. There are, of course, many examples of contortion, but I saw none which really affected or interrupted the general dip, and very often a face of 1800 feet perpendicular is disclosed. The most remarkable feature in the geology of Moab is the frequent intrusion of basaltic streams flowing from the east westwards. These have been ably described and illustrated by M. Lartet, *ibi*. They have scarcely affected, as in the Hauran the general character of the country. The most remarkable basaltic current is that on the south side of the Zerka Main or Callirrhoe, which M. Lartet has so fully examined. The ravine of the Arnon is of a different character, though here too are traces of basalt on its southern side. When we have ascended to the crest of the ridge overhanging the Dead Sea we find the highlands have a scarcely perceptible rise eastward, the watershed being along a range of limestone hills about 50 miles to the eastward, and an apparently level plain intervening for about 35 miles, on which stand most of the ruined cities of Moab, on a soil of surpassing richness—a light red loam, with an occasional denuded hammock of limestone protruding. Eastward of the limestone range, which is locally in Arabia, we heard of, but did not reach, a basaltic or 'black' country, said to be exactly like Hauran, and not less studded with ruins. There seems here to be a yet further field for the archæologist as well as for the geologist."

The Indian Railways drew an audience through the papers "On the Direct Highway to India," by Captain Felix Jones, "The Euphrates Valley Route to India," by Mr. W. P. Andrew, and "The Route to India *via* Russia," by Graf Jaxa de Bykovski. The other papers read in this section have been—"On the Gold Regions of the Limpopo," by Mr. E. Button, "The Place of Geography, Political and Physical, in Education," by the Rev. F. Hale, "Recent Changes of Level in Land and Sea," by Mr. Howorth, "On the Panthays of Yunnan," by Mr. Mayers.

ECONOMIC SCIENCE has not been very active—"The Report of the Metric Committee," by Sir John Bowring, "On International Coinage," by Mr. Herbert Burgess, "A Proposal for Supplying Pure Water to Villages and Country Parishes in the Central and Eastern Divisions of England," by Professor Hull, of the Geological Survey, "Suggestions for Improving and Extending our National Accounts," by Mr. Fellows; "The National Union for Promoting the Education of Women," by Emily A. Shirreff, being the total of its transactions.

MECHANICAL SCIENCE.—The work in this section has been somewhat meagre, being limited to the following essays beyond the three or four already reported, but upon none of which there was any exciting discussion:—"On the Rapid and Economic Transport of Merchandise," by M. Bergeron; "Description of the New Branch Irrigation Canal, leading from the Canal Cavour," by Mr. P. Le Neve Foster, jun., "On the Progress of Invention in Breech-loading Small Arms during the past twenty years," by Mr. A. Wylie, "On Aerial Navigation," by Mr. C. A. Bowdler, "On the Steering of Ships, in special relation to a new form of Rudder," by Mr. Fleming; "On Marine Propulsion (Steam Launches)," by Mr. Eckhart, "On Progress of Through Railway to India," by Dr. Hyde Clarke, and "On Worsop's Auro-Steam System, as applied to Locomotives," by Mr. R. Eaton.

20th August.

GEOGRAPHICAL.—The discussion in this section was brought on by a paper "On the Resumption of North Polar Discovery," by Captain Sherard Osborn, R.N., which was as follows:—

"Although unable to attend this year in person the meeting of the British Association, I trust I shall be pardoned if I endeavour to draw the attention of the Geographical Section to Polar discovery, and ask for sympathy and support to the efforts made by the Royal Geographical Society, in combination with other learned bodies, to bring about a renewal of Arctic discovery by British seamen and explorers. Since the return of Sir Leopold M'Clintock in September, 1859, from his memorable voyage in the *Fox*, and foot journey round King William's Land, no British exploring expedition has passed within the limits of the Arctic zone, and it appears as if English geographical enterprise in the north had for a while become exhausted by the exertions made to rescue or solve the fate of Franklin's expedition. Those exertions, which commenced in 1848 and ended in 1859, yielded a rich harvest of geographical exploration, as a comparison of the Admiralty charts will plainly show. From Baffin's Bay to Behring's Straits, through 90 degrees of longitude and 8 of latitude, the whole northern shores of the American continent and the great archipelago to the north were not only explored, but almost every foot of coast line was searched by ship, boat, or sledge parties. This great task was accomplished by much self-sacrifice, much labour, and considerable suffering, but without any casualties of a serious character. Though British Arctic enterprise rested from 1859, it was not so with other countries. The seamen and geographers of the United States (with that dogged perseverance which forms one of their natural characteristics, never better illustrated than in the recent heroic journey of Mr. Stanley to the rescue of Livingstone) were not satisfied even by the news brought home by Rae and M'Clintock of the dreadful fate of Franklin. M'Clure's accomplishment by ship and sledge of a passage from the Pacific to the Atlantic Ocean, or of Dr. Kane's report of a passage, with much open water, extending northward through Smith's Sound, but they immediately sent forth, by private enterprise, supplemented with Government aid, two fresh expeditions: one under Captain Hall, to try on foot to reach Repulse Bay and the estuary of the Great Fish River, with the object of trying to save any documents left by the last survivors of Franklin's people, and the other to add, if possible, fresh geographical explorations to the promising field up Smith's Sound laid open by the gallant Dr. Kane. Captain Hall, who for seven years lived the life of an Esquimaux, and returned to tell us of a vast amount of relics of the crews of the *Erebus* and *Terror* being strewed about the shores and islets south of King William's Land, to bring home the bones of probably the last survivor, Lieutenant Le Vescomte, only confirms Sir Leopold M'Clintock's opinion that by some sad fatality no written record beyond the one he picked up at Cape Victory existed of that last expedition. Yet the ardour of Captain Hall was so little quenched by these long years of unparalleled hardship that he again volunteered for Arctic labours, and is again now striving with a fresh appointed expedition to secure to his country the honour of a Polar exploration; Dr. Hay, who had been sent out on Kane's footsteps, having in the meantime returned, after carrying up the shores of Grinnel Land, on the west side of Smith's Sound, to the 80th parallel of latitude, only 600 miles from the Pole, with much open water in sight. Whilst our Transatlantic brethren have thus unflinchingly persevered in Arctic research, other European nations have not been idle. Sweden has since 1860 sent scientific expedition after expedition to Spitzbergen, not only to explore that region, but also to test a theory of an open sea extending beyond it, by which the navigator could reach and explore the Polar area—that great unknown space of more than a million square miles lying around the Pole and within the 80th parallel of latitude. Captain Von Otter and Professor [illegible] after repeated gallant efforts, report no probability of reaching it in that direction. Germany for ten years, under the inspiration of Dr. Petermann, of Gotha, has been attempting unsuccessfully to reach these Polar waters by passing between Spitzbergen and Greenland, and after encountering all the ordinary perils of the Arctic voyager, and exhibiting indomitable courage and perseverance, the German leader, Captain Karl Koldewey, returns to tell us in 1871 what Parry, Ross, and Franklin had told us half a century ago, that the outpour of ice between Greenland and Spitzbergen was too continuous and heavy for any navigator to push through, and that on the east of Spitzbergen an open passage to the Pole was a mere philosophical dream. Yet that latter course might still be a subject for geographical dispute had not two gallant officers of the Austrian navy boldly essayed it from Tromso, in Norway, last year. The result of that enterprising little voyage has been so recently laid by me before the Royal Geographical Society that it is unnecessary to repeat it here; but one thing is certain, that as they went northward and reached about the 79th parallel of latitude to the east of Spitzbergen they were fast approaching some unknown land, of which glimpses had only previously been obtained, and which land must block the passage northward in that direction, its existence accounting for the absence of drift Polar ice between Nova Zembla and the North Cape of Europe. These same Austrian explorers have again put forth with the intention of exploring the sea in a north-east direction from Nova Zembla, along the shores of Siberia and Behring's Straits, a course likely to yield rich scientific and geographical results, and we can only wish them the God-speed they deserve at our hands. All these efforts by European nations, barring ourselves, during the last ten years, go to confirm the theory held now by nearly all our Arctic navigators, that the best, the safest, and most promising route towards the unknown pole of our earth lies by way of Baffin's Bay and Smith's Sound, and by that route the President and Council of the Royal Geographical Society desire to see English navigators, associated with competent men of science, make a strenuous effort next year to solve the mystery of whether around our Pole there lie unknown lands and eternally frozen ocean, or an open sea; and I would earnestly call the attention of all lovers of science, or those to whom the honour of our country and the good of its naval profession are dear, to the 'Memorandum on the Resumption of Polar Discovery,' issued by our President, Sir Henry Rawlinson. The harvest that a properly appointed expedition would reap in a scientific point of view is incalculable, and our present knowledge of how well and safely to navigate and explore the Polar regions was proved by the success of all the English Arctic expeditions from 1848 to 1859. The Government and Admiralty have recently shown some desire during a long period of peace to promote through naval expeditions the cause of science, and we hail in the equipment of her Majesty's ship *Challenge*, under Captain Nares, associated with Professor Wyville Thomson, a return to that wise policy of our forefathers which added so much, since the days of Cook, Banks, and Solander, to the sum of human knowledge and the glory of our common country; and I cannot but feel certain that it only requires an earnest representation by the associated scientific bodies of Great Britain, as represented by the British Association, to ensure two small vessels, properly equipped, being despatched in 1873 to Smith's Sound, [illegible] to return to us in a couple of years bringing back a mass of information on all those questions of physical science which Dr. [illegible] recently so eloquently pointed out could only be solved by a scientific expedition in the direction recommended by the Royal Geographical Society."

A discussion followed, supported by Professor [illegible], Mr. Findlay, Mr. [illegible], Admiral [illegible], Mr. Clements Markham, [illegible] and others, [illegible] with the views expressed in the paper.

Mr. [illegible] read a paper on "The Topography of Yeddo," and described the efforts recently made in Japan to raise the political and commercial importance of the country. While this paper was occupying the attention of the section, the Japanese Ambassadors, accompanied by Sir Harry Parkes and suite, entered the room, and were welcomed most cordially. At the conclusion of the paper,

Sir Harry Parkes at the invitation of the President, and amidst great applause, addressed the meeting. He agreed with the remarks expressed in the last few paragraphs of the paper. Yeddo, and in fact all Japan, was in a transition state, and great changes were taking place. Already the whistle of the locomotive was to be heard in Japan, and improvements were going on in every direction. In order to understand the position of Japan at the present time it was necessary to go back a few years and follow the changes which had taken place. Practically it was only ten or twelve years since Japan was accessible to Europeans. Prior to that time Japan followed a policy of strict seclusion, and foreign intercourse was a question of political agitation, and carried on in a most incisive way, as might naturally be supposed where no one moved without weapons. In order to make the necessary changes to consolidate and centralise the government, great difficulties had to be overcome. This work involved the surrender by the nobles of the country of a large portion of their power and some of their possessions. The land was divided amongst 18 principal noblemen and 242 minor noblemen, who maintained small armies of dependants to fight their battles and support their dignity. Then it was necessary to have one head to the government, and the Mikado was declared the sovereign. The barons and nobles gave up much of their power, and surrendered their privileges for the benefit of the country, which then became a political unit. This was a subject for congratulation (applause), as the central power would be better able to protect foreigners and travellers than the older government. In 1868 this central government was formed, and since then the railway system, the telegraph system, and a new currency had been introduced into Japan, besides other important works. This was a very good account to render in so short a time and they might hope soon to have the privileges accorded to the members of the legation of travelling through the country as open to all (applause). The Japanese government had given assistance to the marine survey taken off the coast, and shown great liberality as [illegible]. The very fact of seeing these gentlemen (the ambassadors) here before them, headed by one of the highest nobles of Japan for their chief (applause), and the object of their mission—to learn what was good and suitable for Japanese of the habits and institutions of Europeans—was a pledge that the future of the foreign relations of Japan would be conducted in a liberal and politic manner (applause).

The Chief of the Ambassadors, as the mission retired, sent a message to the President expressing, on behalf of himself and colleagues, their deep feeling at the warm reception they had received.

MATHEMATICS AND PHYSICS.—Professor Clifford read a paper on "The Aims and Instruments of Scientific Thought." It is quite true, he said, that a complete setting forth of the subject would require a comprehensive treatise on logic, with incidental discussion of the main question of metaphysics; that it would deal with ideas demanding close study for their apprehension and investigation, requiring a peculiar taste to relish them. It was not his intention to present such a treatise. The British Association, like the world in general, contains three classes of persons. In the first place, it contains scientific [illegible]. In the second place, it contains persons who [illegible] are called [illegible] about the subjects in a scientific manner. Lastly, it contains persons who suppose that their work and their thoughts are unscientific, but who would like to know something about the business of the other two classes aforesaid. Now, to any one who, belonging to one of these classes, considers either of the other two, it will be apparent that there is a certain gulf between him and them, that he does not quite understand them nor they him, and that an opportunity for sympathy and comradeship is lost through this want of understanding. It is this gulf that he desired to bridge over to the best of his power. That the scientific thinker may consider his business in relation to the great life of mankind, that the noble army of practical workers may recognise their fellowship with the outer world, and the spirit which must guide both, that this so-called outer world may see in the work of science only the putting in evidence of all that is excellent in his own work—may feel that the kingdom of science is within it. These were the objects of the discourse, and compelled him to choose such portions of the vast subject as shall be intelligible to all, while they ought, at least, to command an interest universal, personal, and profound. In the first place, then, he wanted to explain what is meant by scientific thought. You may have heard some of it expressed in the various sections this morning. You have probably also heard expressed in some places a great deal of unscientific thought, notwithstanding that it was about mechanical energy, or about hydrocarbons, or about eocene deposits, or about malapterygii; for scientific thought does not mean thought about scientific subjects with long names. There are no scientific subjects. The subject of science is the human universe—that is to say, everything that is, or has been, or may be related to man.

The soirée in the great halls of the Dome, the temporary picture galleries, and museum have been to-night no less a source of intense intellectual delight than of epicurean feasting. Everybody, of course, met everybody there, and everybody congratulated everybody on the success of the Brighton meeting in enthusiastic terms, commensurate with the extraordinary loveliness of the weather, the inspiriting influences of the sea air, and the remarkable good fellowship which has pervaded every department of the Congress. Indeed, in the sparkling mirror of review only one small speck appears, and this little stain has been promised to be wiped away. The Medical and Chirurgical Society of Brighton gave a private banquet, as they had a right to do, to Mr Stanley, and Mr Stanley left the entertainment in a huff, but as happily the entertainment was a private one, Mr. Stanley's reappearance at the meetings of the Association would obliterate from the highly-polished surface of the historic reflection of the Brighton Scientific Congress all traces of even this slight tarnish brought upon it, although only by the incident that the President of the Association and some of the leading members were present invited guests in the dinner hall where the contretemps occurred. The prominent feature in the philosophical entertainments at the soirée was the illustrations given by Sir Wm. Thomson in the great hall under the Dome of Babbage's proposal that every lighthouse should signal its own identifying letter or number, and two lanterns were shown signalling the Morse letters I and R respectively. Apparatus was also shown for sounding in the deep sea with steel wire. The temporary museum presented all its former attractions, and was as thickly thronged as on the first occasion, notwithstanding it has been open to members and associates during the entirety of the past week. There were of course the additions of microscopes, spectroscopes, and various philosophical experiments, specially adapted for the philosophical entertainment of the guests. In our former notice we described some of the treasures it contains, but by no means all that deserve places in the foremost ranks of interest and attention. [illegible] we omitted one series of perfectly unique value and unrivalled perfection—the complete series of British Cretaceous Brachiopoda exhibited by Mr. Thos. Davidson—a palæontologist known all over the world for his careful and accurate researches on the very extensive families of those singular and remarkable fossil shells of which the cretaceous series form but a very small section. The existence of the Brachiopoda extends in time from the earliest palæozoic ages to the present, and their range of ancestry is marked in every marine geological formation throughout the world. Mr Davidson's researches have extended over a lifetime. He has devoted for nearly forty years to this one subject as much energy as a naturalist as men of business throw into their commercial affairs, and the series displayed is merely an isolated fragment of a gigantic private collection which could supply series quite as perfect and quite as extensive for every division of every geological group of rocks. Mr Davidson's collection could equally illustrate the Silurian, the Devonian, the Carboniferous, the Permian, the Oolitic, and the Tertiary as the Cretaceous, and this too, for foreign rocks as well as British, and when one knows the time, the cost, the labour which Mr Davidson has incurred, the care and beauty of his dissections and of his exquisite drawings, the untiring zeal with which he has laboured, and his never-failing readiness to aid the researches of others and to impart his own information without stint or reserve, one wishes that there had been a Davidsonian Hall at Brighton, in which all those treasures might for once have been displayed which it would be a crime for the next generation of Englishmen if it did not secure for the public museum of the nation. It is indeed a matter of poignant regret that a hall has not been devoted specially to the public exhibition of this collection, and it will be hereafter felt by palæontologists, and generally by the members of the Association, that a rare opportunity has been missed when they find what a splendid mine of treasures has been left unworked. No other group of shells, no other collection, no other place, no other man, could have combined to make a suitable opportunity for such an event as the public exhibition of a whole family of molluscs ranging throughout all the successive geological fossiliferous periods, and throughout all the geological life-areas of our planet. The succession of life generations and the evolution of species could have been thus marked, illustrated, and exemplified, and by no other group of organisms could the modern theories of natural selection have been confronted with such a lengthened and extensive series of examples and facts. We could almost wish that an extra day, say Friday, might yet be devoted to this special purpose.

The objects of ancient art, the relics from tumuli, and the various beautiful photographs exhibited by Mr J. S. Phené are well deserving of notice. The tumuli were opened in the Cumbraes, the Clyde, and on the west coast of Scotland, and on the estate of the Earl of Glasgow in Ayrshire. Some of the photographs represent the different stages in the process of opening the barrows, and the greatest praise is due to the explorer of these relics for the records thus preserved of each condition and aspect before disturbance. Of one tumulus there is a section showing the position of the three tombs or cists, and also the remarkable arrangement of three different soils of which the tumulus was constructed. This collection also contains a valuable series in illustration of serpent worship, commencing with a drawing of the great serpent-shaped mound near Loch Nell, with the triple peaks of Ben Cruachan towards the east, indicative of the mystic Three which figures in every ancient mythology, and was looked upon as indicating a sacred locality when identified with nature. The same case contains also selections from the remarkable monuments described as "symbolical altars," found at Nineveh, and examples of which, though unsculptured, have been found in Britain, Mr. Phené contributing photographs of that found in that interesting earthwork

called Letcombe Castle, in Berkshire, and of another from Ach-na-Goul, on the Duke of Argyll's estates near Inverary. Amongst the practical inventions shown, the models and bricks formed of the refuse ashes of towns and the crushed clinkers and *débris* of iron and other manufactories, shown by the Cottage Improvement Society, Arundel-street, Strand, deserve notice, as being a successful practical attempt to realise good service in two useful social improvements—the advance of the comfort and sanitary condition of the dwellings of the poor, and the utilisation of hitherto useless refuse.

ECONOMICS.—Miss Sheriff read a paper on "Improved Girls' Schools." It was read last Friday, and to avoid clashing with the paramount Stanley demonstration the discussion was postponed till this morning. It became pre-eminently the topic of the day, and the effervescence it occasioned in the Old Ship Assembly Room has only once before been paralleled during the meeting.

GEOLOGICAL.—Dr. Adams promised a report on the "Fossil Elephants of Malta," and Mr. Charles Moore has something important to announce respecting "Naked Echinodermata in the Oolitic Beds."

The Rev. John Gunn read a paper "On the Prospect of Finding Productive Coal Measures in Norfolk and Suffolk, with suggestions as to the places best adapted for an experimental boring."

ZOOLOGY AND BOTANY.—Mr. Mott read a paper "On the Scientific Value of Beauty." He discussed the doctrines of Mr. Darwin and Mr. Galton. Mr. Darwin had attempted to account for organic beauty by the law of sexual selection, but the facts and admissions recorded in his own books showed that this law by itself was inadequate. Beauty could be much more satisfactorily accounted for by the combined effects of Mr. Galton's law of the origin of variation, as explained in his lecture on blood-relationship, with those of the law now advocated: that beauty is the inevitable mark of maturity or climax. There might be a certain modifying influence produced by sexual selection, but beauty would exist whether or not there were any faculty of taste in either sex. In the discussion Sir John Lubbock said he did not think Mr. Darwin would consider variation a caprice of nature. The fact that no two things in nature were subject exactly to the same external condition goes far to account for difference. In a paper on "Natural History Museums," Mr. R. A. Peacock advocated a national museum of this kind. In the discussion complaint was made of the arrangements of the British Museum, and a wish was expressed that scientific studies could be carried on without a curator at the elbow of each student. Local museums were also advocated. The other papers were read in the presence of some half-dozen people, and gave rise to no discussion.

The Mayor (Mr. Cordy) said that he had heard from Mr. Stanley, accepting his invitation to the luncheon which his lordship gives to-morrow in the Royal Pavilion. An earlier answer was received, I believe, conveying a conditional acceptance, as the state of Mr. Stanley's business in London did not permit him to engage himself positively. It is now certain, however, that he will be back amongst us to-morrow, and that his reception at the Pavilion will atone for the untoward default of hospitality he lately experienced there. At the conversazione to-night many distinguished members of the Association have given utterance to their pleasure at the prospect of his taking a more agreeable farewell of Brighton and the Association than he did on Saturday afternoon. The Japanese Ambassadors were expeditious pilgrims to the shrine of science. Before Brighton was well aware of their visit to the geographical lecture, they were conducted by Mr. Beck through the Pavilion, the reading-room, the dome, and the Art Exhibition. They have seen too much of Western civilisation to be awed by the work of modern masters. They perform the circuit [illegible], some of them conversing all the while in excellent English. Their guide, Sir Harry Parkes, was well-nigh superfluous as an interpreter. When Mr. Beck asked to be favoured with their signatures to the visitors' books, they surprised him by the originality of their caligraphy, but afterwards they relieved his curiosity by appending an English translation. To-night's conversazione has been even more successful than last week's. There could not have been much increase of attendance, or greater elegance of display, but people seemed to know each other better than when they first tumbled together in these handsome saloons. They met more acquaintances as they leisurely promenaded amongst the pictures and the odd china. The whole place is more familiar to them.

21st August.

The soirée last night was more crowded if possible and quite as successful as the one on Thursday. About 11 o'clock the Mayor proposed a dance, and Professor Clifford seconded the proposition, which was carried with acclamation, and forthwith the seats were removed from the floor of the Dome, and the dance commenced and was continued with great spirit till about 12.

This evening only three sections sat.

ANTHROPOLOGY.—The Rev. W. Greenwell read a paper on the "Wolds of Yorkshire," in which he described the results of ten years' diggings in the barrows. Several fine specimens of the potter's art were found and described. The section closed with a vote of thanks to the President, Colonel Fox.

CHEMICAL SCIENCE.—Mr. W. J. Cooper read a paper on "A Proposed Method of Preventing the Fermentation of Sewage." He stated that the evil caused by the gas arising from the sewers had become so serious that it had been proposed to erect tall chimneys and send the gases up them. The probable effect would be in our heavy atmosphere to spread a sort of miasmatic pall over the metropolis, and as this vapour, in the opinion of some authorities, is the vehicle for the conveyance of disease germs, there is a danger of the air above becoming charged with plague pustules, which would descend at intervals, forming a shower anything but refreshing to contemplate, and as we should still be annoyed with the gases below our sanitary condition would, indeed, be deplorable. It was to chemical agencies alone we must look for assistance in this dilemma, and it was perfectly practicable to arrest the fermentation of the sewage during its progress through the conduits, and so prevent the evolution of the gas. Whilst treating the roads and streets of London and other towns during the last four years with chloride of calcium mixture, he had found that the waste solution running into the drains had the effect of preventing the unpleasant ammoniacal odour which it was so desirable to remove. This led him to further experiments, and he was convinced that at a very moderate cost (about one shilling per head of population) the sewers of London and other large towns could be rendered perfectly free from gaseous vapours. He proposed to apply a chloride of calcium preparation in a powdered form or in solution to the openings immediately in connection with the sewers at times when the sewers were nearly empty, and especially in times of drought. The effect of chloride of calcium upon carbonate of ammonia causes the decomposition of the latter and the formation of the neutral salts of chloride of ammonia and carbonate of lime. But by treating the sewers at proper times with a chloride of calcium mixture the generated ammonia and its accompanying products of decomposition would be prevented. He had good reason to expect that this practicable process will soon be tried on a very extensive scale in one of our largest towns, and he looked with confidence to the reduction of the death-rate.

A discussion followed both on the paper and on the report of the committee on this subject, in the course of which Dr. Longstaff stated that in a factory of his at Hull a communication had been made between the [illegible] and the factory chimney, and the gas passing through the furnace was decomposed and rendered innocuous. Professor Williams stated the result of some experiments on Mr. Hope's farm—out of 100 parts of nitrogen contained in the sewage put on the land, about 40 per cent. were found in the substance of the plant; about 10 per cent. passed off in the effluent water; and about 50 per cent. was unaccounted for.

Admiral Ommanney, one of the Conservators of the Thames, said the greatest offender against the purity of that river was the Metropolitan Board of Works, the sewage from whose works did not all flow out at ebb tide, but a great part was sent back above the town. Another great offender was Oxford, and at Kingston Bridge some noxious matter was thrown into the river, but a sapient jury said it was not a nuisance, and the Conservators had no power to stop it.

Mr. Hope stated that in Cheshire the average quantity of land for one cow was three acres, but he had grown rye grass on his farm, by the application of sewage, sufficient to feed four cows from the produce of one acre.

Several other speakers addressed the meeting, and a vote of thanks was accorded to Mr. Cooper for his paper.

The concluding meeting of the Association was held in the Dome; Dr. Carpenter in the chair. There was a very full attendance.

The Chairman said the General Committee had some doubts whether there would be sufficient funds to cover their grants for scientific purposes; but he was glad to announce that the treasurer had reported that in consequence of the great sale of tickets there were ample funds to meet all demands.

Mr. Griffith, the Assistant Secretary, said that the total number of tickets issued amounted to 2333 (including 912 ladies' tickets), producing a sum of £2469. He read a synopsis of grants of money appropriated to scientific purposes by the General Committee, amounting altogether to £2025.

Sir J. Bowring moved a vote of thanks to the Mayor (Mr. Cordy Burrows) and the local authorities for the reception they had given to the Association. He congratulated the assemblage on the great success which had attended this meeting of the Association.

Mr. Jeffries seconded the motion, which passed with acclamation.

The Mayor, in returning thanks, alluded to the great exertions of several gentlemen connected with the town w[illegible] assistance, and especially [illegible] museum and picture room[illegible] pictures. But to do a [illegible] quisite that it should [illegible] hoped therefore that the A[illegible] soon hold a second meeting in Brighton.

Mr. Pengelly moved a vote of thanks to the Corporation and the Society of Friends for the use of the buildings, and to the railway company for the facilities they had afforded.

Colonel Strange seconded the motion, which was passed unanimously.

On the motion of Mr. Fawcett, M.P., seconded by Sir John Lubbock, a vote of thanks to the President brought the proceedings to a close.

W. BRIDGES ADAMS.

We have already noted the decease of the above-named eminent civil engineer, and we now present a brief memoir of his life and labours, for which we are indebted to the *Times*.

Mr. Adams was born at Madeley, in North Staffordshire, in 1797. His father, who had settled in London, was the principal partner in the firm of Hobson and Co., coach and carriage builders, of Long Acre, and it was in his father's workshops that as a boy he received his early lessons in carriage construction—lessons which ultimately bore such abundant fruit and aided him in developing the principles of the construction of rolling stock. As a youth he was articled to the late John Farey, and under his tuition acquired his knowledge of mechanics and the principles and construc-

tion of the steam-engine; but, being a youth of weak health, and his life being despaired of, he relinquished his studies and sought health and strength in a warmer climate. The early part of his life was accordingly spent in Chili and other parts of South America, whence he returned at the end of a few years in robust health and with a well-established constitution. Soon after his return to England he was associated with his brother in the conduct of his father's business as a coachbuilder; but, foreseeing the great influence the introduction of the railway system was destined to have upon that business, he retired from it, and established the Fairfield Railway Carriage Works at Bow. It was at these works he first began to develope the power of steam machinery when employed in the workshop, and it was while conducting them that he invented the fish joint for rails, which is now used wherever the railway system has been introduced. But railways and their appliances, though successful in use and of great public advantage, had in their creation never been looked upon as a whole, and to correct their many shortcomings Mr. Adams set to work to improve the methods of constructing railway carriages, of applying break power, giving elasticity to tires of wheels, and radial motion to the axles of wheels; at the same time he sought for a better and more economical distribution of the metal used in the construction of the rails themselves, so as to obtain greater rigidity and avoid destructive wear in the plant generally. Many of the plans patented by Mr. Adams are now in general use, and it is, perhaps, not too much to say that some of our metropolitan lines could scarcely be worked at the present time had his improvements not been introduced. Mr Adams was not a man of one idea, nor did he seek to improve the railway system alone. The lessons he had learnt while visiting foreign countries led him to do much to improve the condition of the labourer both at home and abroad, and he took an active interest in all social and sanitary questions. He contributed largely to the scientific literature of the day, and was at the time of his death advocating plans for improving the construction of trading vessels and vessels used in the Channel passage, as also improved methods of constructing the tramways now being so generally introduced into our large cities; and, with a view to [illegible] the work in which they are at present employed, he had proposed to construct a hot-air engine, of small but adequate power, capable of being used in our [illegible] without creating dirt or refuse. As a [illegible] many articles in the *Westminster* [illegible] the *Journal of the Society of Arts*, and other periodical publications, made his name known in every part of the country. Mr. W. Bridges Adams married for his first wife Miss Elizabeth Place, daughter of the late Francis Place; for his second wife, Miss Sarah Fuller Flower; and for his third wife, Miss Randall, who survives him. He leaves a son, Mr. William A. Adams, issue of the first marriage, and a son and daughter by the third marriage, to mourn his loss. Mr. W. Bridges Adams died at Broadstairs on the 23rd of July, aged 75 years.

The Inventors' Patent-right Association, Limited.—This now well-known and ably conducted Association, the prospectus of which appears in the advertising columns, is, as may be seen from the list of recorded specifications, transacting a large patent business. Its organisation for obtaining patents combines so great economy in the charges with sterling efficiency, and its arrangements are so complete for unravelling disputed questions of [illegible], that it is gratifying to find [illegible] as to its success fully borne out by [illegible]. Members of the Inventors' [illegible] it affords special [illegible] and maintaining [illegible] of the [illegible]

ELECTRICITY THE CAUSE OF THE POTATO DISEASE.

Mr. J. B. Hughes, in a letter in the *Times*, discussing the cause of the potato disease, says:—"Sir,—I have just now been asked, 'Have you seen Mr. Sanghorne's letter in the *Times* which bears out your theory about the potato disease?' As this subject is at this time of national importance, it may not be inopportune to ask you to give me space to set out what I believe to be the cause of the potato disease being under certain influences more active than at other times, and also what has been found to be at least a partial corrective of the influences. From 1845 to the present date I have paid considerable attention to the subject, and I have invariably found that in districts which have been entirely free from the disease, prior to the occurrence of severe thunderstorms, within a very short time after any great electric disturbance of the atmosphere, the well-known blotch has appeared upon the leaves of the potato stalk, and the unmistakable smell of the disease has been perceptible after sunset. During the summers of 1869, 1870, and 1871, there were very few thunderstorms, scarcely any of noticeable violence, and in those years there was little, if any, potato blight; but this year it has followed the course of the violent thunderstorms which have prevailed throughout the country with a painful and undeviating regularity, and we are 'threatened an obliteration of the potato crop.' My theory is, therefore, largely confirmed that the potato disease is rendered more or less active by the electrical condition of the atmosphere. A simple, but effective, palliation of the evil has been found to result from planting a few Windsor or other broad beans between the rows of potatoes. The bean-stalks rising above the potatoes act as natural conductors and carry off the superabundant electricity. The fact may be worthy the notice of and may be improved upon by scientific men, though it comes from J. B. Hughes."

THE NEW AGRICULTURAL ERA.

What a change from the old style, when we only required the aid of the village blacksmith to point the share or do an odd job, besides the shoeing of horses. Now we find ourselves "nowhere" unless we know something about modern agricultural machinery and implements. The necessity of some mechanical knowledge for the British farmer is becoming annually more apparent. The rising generation will grow up in the presence of steam-power and its accompaniments, but ancient farmers and labourers find it hard to understand the management of complicated machinery, requiring close and periodical examination, with strict regard to well-cleansed and well-oiled joints, brasses removed or renewed, well-cleansed and ample-sized flues for the fixed steam-engines. Take the case of reaping machines. Every year they should be taken to pieces and put in proper order, especially the wearing parts, otherwise there will be breakages, or the work will be badly done and the horses unduly worked. The want of a little paint is costly; iron rusts faster than it wears. There is too often gross and unprofitable neglect of farm implements, as though it did not pay to keep the implements and machinery in good order as well as the land. The same remark holds good for fences, ditches, roads, and drains. Landowners should consider that modern farm machinery is costly, and requires proper additional buildings for shelter. All blacksmiths' shops should be now semi-engineer works, with lathe, &c., and a new race of blacksmith-engineers. Custom is second nature, and I believe the repugnance of many farmers to fixed engines and machinery arises from their not having been used to them, and their men not understanding their management. But we are going ahead in the matter of machinery, as is evident by the [illegible] agricultural implement factories here, now become gigantic undertakings, [illegible] for their owners; and all this is owing to [illegible] that mighty and cheap force or power that has enriched our manufacturers and greatly cheapened their productions. So it will be with agriculture when we can all be brought to believe in the economy and profit of steam as a modern power. I have worked my fixed engine for more than 24 years.—*J. J. Mechi.*

GIFFARD'S UNIVERSAL PISTON.

Paul Fiffard, civil engineer, of Paris, the well-known inventor of the Giffard injector, has invented a simple and ingenious form of combined piston packing and valve. The body of the piston is formed somewhat like a deeply grooved pulley, in diameter smaller than the cylinder, and a ring of suitable material, leather or india-rubber, fits loosely within the groove, wherein it is adjusted to act simply as a gas or fluid tight packing, or for combined action as a packing and as a valve, in suction or in forcing action.

In the latter case there is not only a difference in the diameters of the cylinder and piston, and in the depth of the groove and the flexible ring, but there is also a space between the inner edge of the ring and the bottom surface of the groove, as also a difference in the diameters of the two rims forming the groove, the smaller rim having numerous perforations made so as to admit of a free communication for the fluid or gas between the space within the groove and the cylinder space above the piston. Thus, while moving in one direction, the fluid pressure keeps the ring tight against the larger rim and the cylinder, forming a perfect joint, whereas, when moving in the other direction, the ring will be pressed against the smaller rim, leaving free communication from one side of the piston to the other through the inner groove space and the apertures.

When the ring is to be used as a piston packing only, the rims are equal, and both unperforated; and thus at each stroke in either direction the fluid presses the ring firmly against the inner surface of the cylinder and one or the other of the rims, securing perfect action in the pump. The form of the groove may be varied, but it is preferably made conical in section and polygonal in plan, as most advantageous in combination with the hollow cylindrical form of the flexible ring.

CANADIAN PATENTS.

The new Patent Law of Canada came into operation on the 1st of September.

Patents will be granted in Canada for periods of five, ten, and fifteen years. The two first periods may, before their expiration, be enlarged to fifteen years, on simply filing a petition for an extension and paying a small fee.

A model is also required, and on this subject the rule established by the Canadian Commissioner of Patents is as follows:—

Rule 7. Models must be neat and substantial ones, not to exceed eighteen inches on the longest side, unless otherwise allowed by special permission; such models must be so constructed as to show exactly every part of the invention and its mode of working. In cases where samples of ingredients are required by law, they must be contained in glass bottles properly arranged; but dangerous or explosive substances are not to be sent. Both models and bottles must bear the name of the inventor, the title of the invention, and the date of the application; and must be furnished to the Patent Office free of charge and in good order.

It will be observed that the foregoing rule only requires that every part of *the invention*, and its mode of working, shall be exhibited in the model. If the invention consists of an improvement upon *some* part of a known machine, it will not be necessary to make a model of the whole machine, but only those parts that are needed to show the intended working of the improvement. *For example*, if the invention relates to vehicles, and consists in an improvement in the construction of the wheel and axle, it will not be necessary for the

inventor to furnish a complete model of the vehicle, but only a model of a wheel and axle made according to the improvement. This is also the rule at the United States Patent Office.

For the information of those who contemplate taking out Canadian patents, Messrs. Munn and Co have prepared a circular containing full directions, copies of which can be had free of charge by simply addressing the Secretary of the Inventors' Patent-right Association, Limited, 21, Cockspur Street, Charing Cross.

FIRELESS LOCOMOTIVE.

Dr. Emile Lamm, of New Orleans, whose invention of the ammonia engine, says the *Scientific American*, we recently described, has been giving his attention, with very successful results, to the economic and absolutely safe propulsion of street cars by means of steam-power.

Satisfied from the collected experiments of the past century that the efficiency of steam, together with its intrinsic cheapness, could not be called in question, although the objections to its use lay, first, in the constant danger attending its generation in a boiler placed over an active fire; and, second, in the consequent expense incurred when such a boiler is used with a small engine doing but little work, for the ever-present danger has to be guarded against with a care equal to that required for a much larger apparatus, and a skilled attendant must therefore be employed at a very disproportionately high price—from this he concluded that if the danger attending the ordinary steam-engine could be avoided entirely, a skilful attendant would not be needed to drive it, and the problem of working steam cheaply on a small scale would be near solution.

These conclusions led him to the invention of the "thermospecific" or fireless locomotive.

In this invention he makes suitable connections between a stationary steam boiler and a steam reservoir mounted on wheels like the ordinary locomotive, having the usual working parts of the engine connected therewith. This reservoir is first heated throughout, and then a sufficient supply of water of the requisite temperature is forced into it. When properly charged, the water is flush with the water-cock, and its temperature about 380° Fah., the pressure in the reservoir being about 170 lbs. to the square inch. The locomotive is then ready to be started on its trip, there being sufficient power stored up in the reservoir to enable it to run the attached car a distance of nine miles without expending the whole of it. Before beginning the next trip, the charge is renewed by again coupling the reservoir with the stationary boiler, from which steam is forced in for about four minutes through the perforated pipe, by which operation the temperature and pressure are restored, and the water which went off in the form of steam during the previous performance of the engine is replaced.

The absence of danger of explosion in using this apparatus is claimed as one of its merits. The pressure in the reservoir never rises above the point reached at the time it is charged, and after that it is necessarily continually diminishing as the power is expended. It requires even less skill to drive this locomotive than it does to drive a horse or mule car, and the economy sought in this direction appears to be fully maintained. General G. T. Beauregard, who is president of the New Orleans and Carrollton Railroad Company, on whose road Dr. Lamm's fireless locomotive has been running, and who have just adopted his invention, has made a comparison between the relative expenses of the two systems, and finds a difference of 33½ per cent. in favour of the new over the old.

The calculations for the new system were based on fifteen locomotives supplied by one set of stationary boilers. One particular advantage claimed by the inventor, who has already made over a thousand trips of six miles each with his locomotive, is the latitude allowable in its construction and application by reason of the absence of the furnace.

Fixed and Revolving Turrets.—The firing of the *Hotspur's* gun from her fixed turret at the revolving turret of the *Glatton* was to test whether the revolving gun of the latter was liable to become deranged in action. The result has shown that the gear will stand fire; and the manifest advantages of revolving over stationary turrets has determined the Admiralty to adopt the former. The *Hotspur*, now being paid off, will have her internal fittings so modified as to allow her fixed turret to be replaced by a revolving one. For this purpose Parliament will be asked to vote £25,000 next session.

Correspondence.

*** Discussion is invited upon any subject within the scope of the Scientific Review in which its readers may be interested; but correspondents are requested to be brief, as space is limited, and to remember that each individual writer is alone responsible for the opinions he may express.

NOVEL IMPROVEMENTS IN CARTRIDGES AND FIREARMS.

To the Editor of the Scientific Review.

Sir,—Having discovered, during the late Franco-German War, the defects and imperfections of the various small arms and cartridges in general use, I determined to make experiments for the purpose of removing such defects, and producing small arms and cartridges at a cheaper rate than heretofore. It is a well-known fact that the Snider, Albini, Martini-Henry, Remington, and other arms, require copper, iron, or other metallic bases, to receive the charge of powder and bullets, for the purpose of preventing the escape of gases from such and other breech-loading firearms, such bases costing from two to three pounds per thousand, which shows an absolute waste of money that can be dispensed with by using my gun breeches and cartridges, as all other breech-loading guns at present in use require copper or other bases, as before mentioned, also extractors to withdraw such bases, which entails a considerable loss of time in rapid firing, as well as the additional expense in manufacture

In the second place, I found that all cartridges which were made for Chassepots and other small arms (not requiring copper bases) with paper, linen, calico, silk, or other materials then in use, were such as to foul the barrels and locks to such an extent that it was absolutely necessary the guns should be sponged out after firing about 10 rounds. Therefore the first object I had in view was to produce arms to fire cartridges without copper or other bases, and, secondly, to manufacture cartridges that could, by no chance whatever, foul the guns Having succeeded in accomplishing these objects, I beg to recommend my guns Nos. 1 and 2, which can do all that can be desired. Gun No. 1 is a combination of the Snider and Chassepot, having a bolt to draw backwards and forwards similar to the Chassepot, with a plunge chamber similar to the Snider, and the advantage of a strong resisting block and catch, which prevents the bolt coming out of its place by the concussion of firing, and can be made to take either Snider or Chassepot cartridges. All small arms can be converted to this and my other principle at a trifling cost.

No. 2 gun is constructed with a chamber and block working upon an axis similar to the Albini, with a strong hollow steel catch ⅝ of an inch in diameter, the hollow being made to receive and encase the needle, which needle is actuated by a plunger passing through the tail pin, put in motion by a tappet working on a spindle, attached to a tumbler on a common lock. It is an established fact that no gun lock has ever yet been made that could supersede the ordinary musket or gun lock. I have now obtained with the ordinary gun lock a first-class breech action, with a central-fire needle, that will fire a cartridge without a copper base, and thus reduce the cost of such military cartridges 30s. per thousand, and the cost of Chassepot cartridges 10s. per thousand, thus giving a much superior article at a cheaper rate.

I also paid special attention to the Chassepot cartridge, knowing its very great defects, and have produced an article I can strongly recommend for the following reasons, namely:—

Firstly: Saving of powder at least 10 per cent., producing a much better result.

Secondly The cartridge case is entirely destroyed when the sulphurous acid gas comes in contact with it from the explosion of the gunpowder, which reduces the case to a metallic oxide, forming a high polishing powder which leaves no residium behind to foul the guns.

Thirdly: A more complete combustion of the powder and reduction of smoke.

Lastly. A great number of experiments have been made, and several thousand cartridges fired, some before Mr. Charles Rule, 10, Clement's Lane, London, others before Mr. Van Winkle, 4, Lawrence Pountney Hill, Cannon Street, and many other scientific gentlemen. Several experiments were also made at the Gunpowder Works of Messrs. Pigou and Wilkes, Dartford, Kent, both with open firing at a target, and also at their chronograph, the last trial having taken place on the 17th June, when the following highly satisfactory results were obtained.—

Fifty cartridges were first fired into their chalk pit, to ascertain whether they would foul the barrel of the gun, and afterwards ten cartridges were fired at the chronograph with five different qualities of powder, two cartridges of each quality. The first five produced, according to the Government table, a velocity of 1338 feet per second, with 72 grains of powder only, the usual charge in all my Chassepot cartridges, as against 85 grains by the Martini-Henry. The second fire, with same quality of powder, produced 1366 feet per second. Third ditto, with another quality of powder, 1340 feet per second. Fourth ditto, with same powder, 1361 feet per second. Fifth ditto, with next quality of powder, 1380 feet per second. Sixth ditto, same powder, 1386 feet per second Seventh ditto, with Messrs. Pigou and Wilkes' No. 4 powder, produced the enormous velocity of 1523 feet per second, and the eighth fire 1525 feet per second, which utterly astonished Mr. Cummings, the manager, a gentleman who has necessarily had a long and vast experience in all kinds of experiments of a similar nature—in consequence of the small charge of powder I was using with the Chassepot cartridge (namely, 72 grains, instead of 85, as used by the Martini-Henry), producing a much greater velocity per second, as it exceeded the highest range of the Government printed table, and the register therefore, could only be taken by calculation. The next two cartridges were fired with powder obtained from another of the best manufacturers, No. 9 producing 1435 feet per second, and No. 10 1422 feet ditto. After all this firing the barrel of the gun was examined, and a piece of clean linen rag forced through with a ramrod, which was found to be scarcely soiled, and is now open to inspection.

Another advantage was discovered, proving that whilst the breech of the gun after all this firing remained perfectly cool, the muzzle, on the contrary, was rather warm, showing that complete combustion had taken place amongst the materials of the charge, as, instead of smoke, nothing but flame issued from the muzzle.

It must be also noted that during the whole of these trials the bullets used were made in a split mould and not pressed, therefore the fullest advantage was not obtained.

Therefore, from the above facts, I claim that my invention far surpasses and supersedes all others in the following important respects, viz.:—1. Smallness of cost of manufacture; 2. Greater velocity; 3. Not fouling the gun; 4. Not requiring metallic bases; 5. Complete combustion of the powder, causing a great reduction of smoke.—I remain, your obedient servant,

W. H. Tooth.

The Patent Metallic Cartridge Works,
Albany Terrace, Old Ford Road,
Bethnal Green, Sept. 21, 1872.

APPLICATIONS FOR LETTERS PATENT.

(Continued from page 142.)

W. Ansell. Breech-loading small-arms.—2350. T. Silver. Rarefying lamp-burner.—2351. G. H. Moore. Improvements in the process of evaporating or concentrating alkaline liquors in the manufacture of caustic soda, caustic potash, soda ash, and other similar substances; also for heating or boiling and refrigerating solutions in breweries, distilleries, chemical and other manufactories, and in the apparatus employed therefor.—2352. B. Turner, J. Hibbert, and J. Cheetham. Machinery for blocking hats.—2353. W. Grimshaw. Machinery for "planking" or "felting" hats and other coverings for the head.—2354. A. M. Clark. Magazine and other breech-loading fire-arms and cartridges (com.)—2355. A. Clark. Manufacture of corrugated metal revolving shutters, and in machinery for the same.

On August 8th.—2356. J. Sebberton. Means of and apparatus for ventilating railway carriages. —2357. C. Morfit. Artificial substitute for "redonda guano," "alta vela" guano, and other natural phosphates of alumina to be used in the defecation of sewage, in the manufacture of sugar from cane and beet-root juices, and in the preparation of certain chemical products, such as pure alumina, and the alkaline and earthy phosphates and aluminates.—2358. T. Warren. Improvements in and connected with furnaces employed in the manufacture of glass.—2359. J. Oldroyd. Construction and working of hydraulic engines.—2360. A. Maw. Apparatus to be employed in preparing the clay used in the manufacture of encaustic tiles and other articles requiring similarly prepared clay.—2361. A. Jaynor. Manufacture of artificial stone or compositions suitable for pavements, architectural and other purposes.—2362 S. Myers. Gas-lighting apparatus (com.)—2363. R. W. Morris. Revolving shutters.—2364. R. Hornsby, J. E. Phillips, and J. Innocent. Reaping and mowing machines.—2365. S. H. Hadley. Cleaning wheat and other grain, and in apparatus employed therein (com.) (Complete Specification.)—2366. J. Lane and W. Onions. Apparatus used in brewing.—2367. R. Mill. Improvements in or connected with steam boilers

On August 9th.—2368. J. Drummond. Reaping and mowing machines.—2369. W. R. Lake Nutritious compounds (com.) (Complete Specification.)—2370. G. H. Nussey and W. B. Leachman. Machinery or apparatus for pressing woollen and other woven or felted fabrics. —2371. H. D. Harrison. Kilns or ovens for burning bricks, tiles, and other plastic forms. —2372. F. G. M. Stoney. Stop valves or sluices.—2373. B. Bagster. Locks or fastenings for railway and other carriage doors, and for other uses.—2374. R. Willis. Apparatus for clipping horses and other animals.—2375. E. Shaw. Perambulators.—2376. F. W. Scott. Belts or bands used for colliery winding, suspension bridges, and other purposes.—2377. A. G. Speight. A new or improved manufacture of fronts for personal wear.—2378. T. H. Rushton and W. Dobson. Machinery for ginning cotton.—2379. W. M. Adams. Instrument for the solution of triangles.—2380. T. Broughton. Construction of iron girders, joists, or beams used in constructing buildings. —2381. J. Pickering. Construction of spring mattresses and other articles for sitting or reclining upon.—2382. T. H. Rushton and R. Tongs. Machinery for spinning and doubling.

On August 10th.—2383. J. J. Bodmer. Instrument or appliance for sharpening knives and other cutting tools.—2384. D. Macfarlane and R. Macfarlane. Improvements in dyeing, and in the apparatus employed therein.—2385. T. J. Denne and A. Hentschel. Waterproofing. —2386. R. Sutcliffe. Apparatus for utilising exhaust steam for heating feed water for boilers and other purposes.—2387. R. F. Fairlie. Improvements applicable to locomotive engines. —2388. H. Gledhill. Machinery or apparatus applicable for either scouring or washing worsted or other textile fabrics in the piece.—2389. [illegible] Bonneville. Manufacturing [illegible] (Complete Specification.)—2390. [illegible] Improved means or apparatus [illegible] signals from passengers to [illegible] of railway trains.—2391. [illegible]

Manufacture of matches.—2393. S. Barton. Apparatus for protecting the face and head, and permitting respiration in places where the atmosphere is charged with noxious gases or vapours, smoke, or other impurities.

On August 12th.—2394. G. Dixon. Manufacture of fringes and upholsterers' trimmings, applicable also in the manufacture of textile fabrics.—2395. J. G. Williams Apparatus for heating, cooling, and fermenting liquids, and for infusing, attemperating, and mashing, especially applicable in brewing and distilling. —2396. R. Hadfield. Improved process for combining crucible steel with pig iron or other similar metal.—2397. G. Haseltine. Apparatus for adjusting the screw propellers and rudders of canal boats and other vessels (com.) 2398. E. Probert. Asphalte roads and pavements in combination with wood.—2399. J. Richardson. Dyeing textile fabrics.—2400. G. Heyes and T. Entwistle. Warping or beaming machines.—2401 T. Joseph. A new or improved method of cooling mines, and of cooling and ventilating houses, ships, churches, factories, and other structures or places, applicable also for abating heat, smoke, and steam in tunnels and other confined places.—2402. J. Newton. Means of and apparatus for consuming smoke and economising fuel.—2403. A. M. Clark Medicinal compound (com.)

On August 13th.—2404. A. M. Clarke. Looms (com.)—2405. P. McKinlay. Husking, hulling, or shelling, and for cleaning and preparing rice and other grain.—2406. B. Hunt. Refrigerating apparatus for ships or vessels, for railway carriages or cars, or for other structures or places (com.)—2407 C. Randolph and C. R. Harvey. Tramway carriages to be propelled by steam or drawn by horses.—2408. J. Horton. New or improved mode and means of cooling the tools for turning and planing metals.—2409. J. Finches. Presses for embossing, stamping, perforating, or punching, and an improved die and counterpart for embossing and perforating.—2410. G. W West. Machinery for ginning cotton (com.)—2411 T B Daft. India-rubber manufactures, and tools and machinery employed therein 2412. H Green. Apparatus for washing and separating ores and other minerals (com.) 2413. T. Thomson. Anchors.—2414 G. Haseltine. Holder for scrubbing-brushes and other similar implements (com.)—2415 W. B Chapin. Fastenings for railway fish joints.

On August 14th.—2416 S. Chandler, sen., S Chandler, jun., and J. Chandler. Dip pipes for regulating the seal in hydraulic mains used in the manufacture of gas (Complete Specification.)—2417. F. D Blyth. Process and apparatus for treating wood for the manufacture of pulp for paper.—2418. H. Crawford and J. Crawford Machinery for finishing thread and yarn.—2419 T R Rossiter. Sewing machines.—2420. J Ridsdale. Lamps.—2421. J. J. Blackham Gas stoves.—2422. E. T. Hughes. Machinery or apparatus for manufacturing cigars (com.)—2423 E. T. Hughes Horizontal centrifugal sifting machine (com.)—2424 W B. Chapin. Adjusting spanner.—2425. W R. Lake. Distilling and steaming apparatus (com.)—2426 D Joy Means and apparatus for purifying iron, and for removing the slag and other impurities from blast and other furnaces

On August 15th.—2427. J. Thorpe. Mode of and in apparatus or machinery for ornamenting in colours floor, oil, and leather cloths.—2428. C. H. Cawse. Apparatus for regulating the supply of water to waterclosets and other vessels.—2429. T. J. Denne and A. Hentschel Combination of ingredients for treating, preparing, stiffening, and thickening raw, felted, spun, and woven fibre and fabrics, also for use in dyeing and printing such fabrics and fibres. —2430. E. T. Hughes. System or mode of manufacturing cigars and cigarettes, in which the bunches or interiors are formed of cut tobacco, having all its qualities preserved, and the ends of the cigars which are put in the mouth made impermeable (com.)—2431. T. Routledge. Treating fibrous substances for textile purposes, and for the manufacture of paper stock.—2432. W. Morgan-Brown. Machinery for the manufacture of horse-shoe nails. (com.)—2433. J. H. Johnson. Improvements in propelling boats, and in apparatus employed therein (com.)—2434. L. D. B. Gordon. Manufacture of iron and steel (com.)—2435. G. Haseltine. [illegible] (com.) —2436. O. Bernhardt. Carding engines.—

2437. E. D. Barbour. Improved calculating machine. (Complete Specification.)—2438. T. Broughton. Construction of roofs and other parts of buildings.—2439. J. Judson. Governor valves for steam-engines (com.)—2440. G. Haseltine. Steam boiler furnaces (com.)—2441. J. H. Johnson. Sewing machines (com.) —2442 G Haseltine. Chamber vessels (com.) (Complete Specification.)—2443. W. R. Lake. Puddling furnaces (com.)

On August 16th.—2444 N. Sohor. Improved instrument for facilitating the cutting out of cloth for coats and other garments.—2445. C. F. L. Goffrié and J. H. Schucht. Pianoforte, harmonium, and organ keys.—2446. A. R. Arrott. Manufacture of carbonate of soda.—2447 D. Nash Rocking cradles.—2448. S. Platt. Self-acting mules and twiners for spinning and doubling cotton and other fibrous substances.—2449. H. F. Freutel. Manufacture of hats and caps out of American, japanned, glazed, or other similar cloths in all colours.—2450. F. Lipscombe. Treatment of noxious vapours.—2451. S. H. Emmens. Roadways, paths, and floorings.—2452. E. Baller. Cocks or valves.—2453. S. H. Emmens. Producing heat and light.

On August 17th.—2454. W. Ferrie. Furnaces for smelting iron.—2455. T. Christy. Ventilating ships or vessels and other places (com.)—2456. E. T. Hughes Manufacture of loaf sugar, and in the machinery or apparatus employed therein (com.) 2457. C. Barlow. Sawing wood (com.)—2458. C. Cail. Paper-cutting machinery, which improvements are also applicable to machinery for receiving printed sheets from printing presses.—2459. G. P Dodge Cement for the joints of pipes and other apparatus for containing or conducting steam, water, or other fluids.

On August 19th.—2460. W. R. Lake. Apparatus for automatically igniting gas (com.)—2461. W. R. Lake. Electro-magnetic signalling apparatus (com.) (Complete Specification.)—2462 H C. Davy. Apparatus for registering, indicating, and checking the numbers and fares of and the distances ridden by passengers travelling in tramway cars, omnibuses, or other carriages.—2463. W. A. Lyttle Railway and tramway sleepers.—2464. W. Morgan-Brown. Leather-splitting machine (com.) 2465. W B. Williamson and E Hitchin. Fastenings for boxes, trunks, portmanteaus, and other like articles.—2466. W. E. Newton. Furnaces or fireplaces for generating heat by the combustion of coal (com.)—2467 G. Barnley. Apparatus for lettering or marking name-bands for umbrella and other handles. 2468. A. Hughes. Reaping and mowing machines.—2469. W. C. Church Hydraulic engines, partly applicable to steam hammers, hydraulic rams, and pumps, and to valves for regulating the flow of fluids under pressure 2470. T. M Robson. Apparatus for cutting cardboard and other like substances, parts of which improvements are applicable to planes for cabinet and other like work 2471. W. D. Cay. Construction of breakwaters, piers, and other structures in water or in the sea, and in apparatus employed therein.

On August 20th.—2472. J. Brodie. Construction of fastenings for gates and doors, drawers, lids, and desks.—2473. R. Stone Improved concrete for surfacing or laying roadways, footways, and other similar large surfaces.—2474. T. Palmer, A. Pickup, and S. Carter. Sewing machines.—2475. O. Ingham. Pickers for looms for weaving.—2476 A. Daies. Percolation.—2477. W. Truswell and R. W. Holden Supplying hot air to furnaces, cupolas, smiths' hearths, and other fires, to bakers' and other ovens, to kilns for drying and burning bricks, and for utilising the fire in open fire-grates for making hot air and supplying it to rooms in private houses or public buildings.—2478. A. M. Clark. Cotton gins (com.)

On August 21st.—2479. P. Laurenson. Producing book-binding clasps or mechanical book-binders (com.)—2480. J H Johnson. Supplying hot blast to blast and other furnaces, and in the apparatus or means employed therefor (com.)—2481. M. Gally. Automatically arranging or constructing forms for printing communications or other kinds of printed matter at hand or at a distance.—2482. J. Dodd. Mules for spinning and doubling cotton and other fibrous materials.—2483. B. Hunt. Physiological or "bullion" battery (com.)—

2484. W. Ambler Machinery for the manufacture of paper tubes.—2485. A. C. Bamlett. Reaping and mowing machines.—2486. W. Chaine. Saddle-bags for carrying water.—2487. W. Young, P. Brash, and A. Scott. Improvements in the destructive distillation of coal, shale, and other bituminous substances for the production of illuminating gas and of oils. - 2488 G. Haseltine. Treadle mechanism (com.) (Complete Specification.) — 2489. H J. Griswold. Knitting machinery (Complete Specification.)

On August 22nd.—2490. E. Rostron. Machinery employed in the manufacture of felt —2491. C E Sebille. Improvements in the composition known as "schisto-asphaltic and bituminous-beton,' and novel applications thereof, together with improved machinery or apparatus in connection therewith.—2492. G. Haseltine Railway carriage springs (com) - 2493 G. Haseltine. Electrical apparatus to be worn upon the head for the alleviation and cure of nervous affections (com) (Complete Specification.)— 2494. T. A. Weston Friction clutches, and the arrangement and mode of operating frictional surfaces for transmitting, regulating, and arresting motion in machinery.— 2495. J. Winskill. New or improved construction of lime-kiln.—2496 M. H Synge Deodorising apparatus. - 2497. J. R. Wright and A. Alexander. Treatment of iron and manufacture of steel.—2498. W Brookes. Means for stopping the working of apparatus on the breaking or failure of thread in the roving, spinning, or twisting of wool, cotton, or other fibres (com) (Complete Specification)—2499. J. Thornton Utilising borings, turnings, filings, planings, and other particles of iron – 2500 M Henry Improvements in the mode of and machinery or apparatus for preparing fibrous materials for being spun (com.)—2501 J Edwards. Signal alarums for railway trains —2502 C. O'L. L Prendergast. Improved means and apparatus whereby passengers in a railway train can communicate a signal to the guard and driver.

On August 23rd - 2503. J. Morgan An inhaler for medical purposes - 2504. W. Morris Making connections with water mains under pressure.— 2505. C. Blackmore Ornamenting surfaces —2506. E. A Cook Treating animal charcoal.—2507. J. Clay. Saddles.- 2508. P Varnaison. Apparatus to allow of producing rapidly the vacuum in the night-carts.— 2509. T. Henderson. Aparatus for supplying fuel to furnaces, and for removing clinkers from the same. (Complete Specification) - 2510. W. Vincent Apparatus for manufacturing gas.—2511. W. Carwood Presses for letter-press printing.- 2512. W. H. Hartfeld. Apparatus for multiplying power, applicable to windlasses cranes, hoists, and other machines.— 2513. R. Warry. Portable cooking stoves.

On August 24th.— 2514. H. Alder. Dry meters. — 2515. R. Goodall. Improved means or method of and apparatus for clarifying impure or waste water from fulling mills, scouring mills or scouring processes, dye houses, sewage, and other impure waters. — 2516. T D. McFarlane. Improvements in loading grain into or discharging it from ships and other places, and in apparatus employed therefor. - 2517. H. A. Bonneville. Machines for cutting textile and other materials (com) -2518 W. Lockhead Treating and applying asbestos or amianthus — 2519 J. G Tongue. The application of platinised glass or "glace platinée" to various articles, such as needle and perfumery boxes or cases, and other useful or fancy articles (com) — 2520 C. W. Stones and A Lowcock. Arrangement and construction of movable weirs and sluices—2521. C Bartholomew, C.E. Machinery for cutting coal. — 2522. P. M. J. Chamblant. Sewing machines.

On August 26th.—2523. J. Field. Field and garden hoes and other like implements.—2524. E. Hoskins. A new mode of constructing and adapting the frames of bedsteads for the reception of tensional or other spring mattresses, as also in the means of applying such tensional or other spring mattresses to iron bedsteads.—2525. J. M. Plessner. Obtaining and applying motive power, and in apparatus to be employed for the same.—2526. R. H. Radcliffe. Improvement in the arrangement for the screw propeller in steam ships.—2527. C. Frickinger. Manufacture of malleable iron, and in the furnaces employed therein. — 2528. J. F. Parker and A. Wade. Manufacture from coal and petroleum of hydro-carbon gas, or gas for illuminating and heating. — 2529. H. A. Dufrené. Preserving fruit (com)—2530. T. S Harrison Attachment for sewing machines (com.)—2531. T. S. Harrison. Attachment for sewing machines. — 2532. T. S. Harrison. Apparatus for oxidising metals (com.)—2533 Sir A. Fairbairn, Kt., T. S. Kennedy, and J. W. Naylor. Machine to draw out and straighten the fibres of silk, flax, hemp, jute, or other fibrous substances.—2534. A. S Ellefsen. Apparatus for generating steam.—2535 E. H. Huch Apparatus for cooking and for making coffee and other infusions (Complete Specification.)—2536. J. G. Tongue Closing and securing packing cases or boxes (com.)—2537. G. Haseltine Machine for making screw taps (com.) (Complete Specification.)—2538. H. Y. D. Scott Treatment of sewage, and in the preparation of manures therefrom. — 2539. G. F. Newton. Improved machine for burnishing, rolling, and setting leather.—2540. A. Henry Breech-loading fire-arms. (Complete Specification.)

On August 27th.—2541. J. S. Stevens. Window-sash fasteners —2542. W. W. Box. Apparatus used in the manufacture of gas — 2543. J. Stone Apparatus for warming bed and other rooms, also applicable for warming or heating churches, conservatories, greenhouses, or other buildings or rooms requiring warming or heating.—2544 A. N Dubosq. A new system of landau carriage — 2545. C Morfit Improvements in vats or vessels for the various chemical and manufacturing operations which involve the use of acids - 2546 A M. Clarke Fire-arms (com) 2547 H Highton, M A Submarine and other cables for the conveyance of electricity -2548. A Bryce Branding stoves. 2549 W. Millen and J. Muir Holding punches and drills in punching and drilling machines, and in the means employed therefor.- 2550. C H Hall. Steam [illegible] with steam boilers [illegible] analogous apparatus. (Complete Specification)—2551 R Foster Apparatus for condensing steam and other vapours, and for refrigerating fluids. -2552 J R T. Mulholland Looms for weaving.

On August 28th.- 2553 H A Bonneville. Child's carriages or perambulators (com) (Complete Specification) 2554 J Mackintosh and W. Boggett. Manufacture of life preservers, air beds, cushions, and coverlets, and in the materials employed therefor. - 2555 J J Hicks. Infants' feeding bottles. - 2556 G Grainger. Tiles or slabs, and in attaching tiles or slabs to surfaces 2557. E. Busby Respirators. - 2558 J Bird. Warming or heating sheds or rooms for drying bricks, tiles, quarries, and other articles made of clay — 2559 J T Dann. Machines for washing, concentrating, and amalgamating ores of precious metals (com) 2560 W. Green Apparatus for effecting the saving of fuel used for domestic purposes.—2561 W F. Newton. Printing machinery (com.)- 2562. T. Winter Fire-escape. 2563. W. R Lake. Type-setting machines (com) 2564. E Hayes. Tilling land. 2565 F St. G. Smith. Plugs and ferrules for the tubes of steam generators (com)

On August 29th.—2566. R. S. Bond Perforating machine 2567. H. C. Symons. Sewing machines, accessories, and stands - 2568. H. C. Hill Horse-shoes, part of such improvements being for preventing horses from slipping on asphalte pavements, and part to supersede the necessity for roughing -2569. B. W. Gerland., Ph D , and E. Johnson. Manufacture of sanitary charcoal, and the application thereof to the treatment of sewage. — 2570. J. Macaulay. In weaving ornamental fabrics.—2571. W. R. Lake. Apparatus for regulating the blast of locomotive engines (com.)—2572. W. R. Lake. Improved compounds, chiefly designed for coating ships' bottoms (com.) (Complete Specification.)—2573. J. Hargreaves and T. Robinson. Manufacture of hydrochloric acid, and in apparatus employed therein.—2574. R. A. Purkis and J. N. Lessware. Safety label to be applied to closed receptacles for indicating when such receptacles have been tampered with, together with apparatus for securing and marking such labels.

On August 30th. — 2575. J. Thomas. Means and apparatus for heating steam boilers, consuming smoke, and ventilating the stoke-holes, engine-rooms, or other parts of steam-ships.—2576. G Spencer. Purification of coal gas used for illuminating purposes, and for mechanical purposes (com.)—2577. C. Judkins. Wet and dry gas regulators.—2578. A. H. Guffroy Steam boiler (com.) (Complete Specification.)- 2579. S. Mathews. Breech-loading small arms — 2580. J. Stone. Improved apparatus for warming the feet. — 2581. J. Whitworth. Apparatus for applying adhesive substances to spindles employed in spinning cotton and other fibrous materials.—2582. G. Mudford. Straps, driving-bands, and belting for machinery.—2583. C. M. Cox. Cooking apparatus.—2584. K. W. Zenger. Pressure gauges. — 2585. J. H. Johnson. Parallel rulers (com.)—2586. J. Robertson. Generating heat, and in the apparatus and means employed in the application thereof to various purposes. —2587 W R. Lake. Electrical apparatus for lighting gas and other burners (com.)—2588. T. W. Studolph. Bedsteads, and appliances for securing false bottoms or sackings in position.

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AND

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The Scientific Review.

NOVEMBER 1, 1872.

RAILWAY SAFETY DEPENDENT ON INVENTION.

AGAIN a frightful railway casualty is brought under public notice by the accounts of the northern railway accident which have lately filled the columns of the public journals, and this time the fact is duly acknowledged that the poor overworked railway official cannot justly be considered worthy of criminal punishment, considering the state of doubt and difficulty in which he was placed. Indeed it is thought he may be fairly held excused for not being able to take the right course of action instead of the wrong one.

This view of the case is to us the proper one, but we trust it will be followed by the transference of the blame from the railway official to the railway directorate, for it is quite clear that the adoption of those mechanical safeguards which the genius of inventors has placed at the disposal of those who are responsible for the management of railways would have averted this dire calamity, since by the use of the "interlocking system" for moving the signals and points, such an accident as the one we have referred to would in all probability never have occured.

Years of experience of our railway system render it perfectly apparent that unless stringent measures are adopted to compel railway boards to do their duty to the public in regard to the convenience and safety of travelling, very little will ever be done. For our part we should not like to recommend the hanging of a railway director or two whenever a fatal accident occurs, but it really seems as if the necessities of the case would justify such an act of severity, and we are quite prepared to advocate that those who are responsible for railway management should be subject to heavy fines in cases of accidents like that we are now speaking of, as a punishment for not adopting the best means for ensuring the safety of their passengers. Possibly, however, a surer remedy would be the adoption of the plan advocated in the paper read before the Inventors' Institute last session by Mr. Raphael Brandon, for nationalising our railways, or by making arrangements for working them according to Government regulations and under Government control. This would enable passengers, through their representatives in Parliament, to take effective measures for ensuring attention to their comfort, and safety when travelling on railways. Certainly it is monstrous that in this country of mechanical genius and ever active industry we should have amongst us public bodies like railway boards, who simply ignore all the essential mechanical requirements of the business in their charge, and yet remain practically exonerated from all responsibility in the matter.

How many have been the inventions for improving the safety of railway travelling! The number is so large that their name is legion; and yet they have been most of them unheeded by the railway authorities, who think their duties well performed if they can manage to present their shareholders with a dividend, however small, and bag their own fees for board attendance.

Should this lamentable accident open the eyes of our legislators to see the necessity for making provision for the adoption of new inventions on railways for promoting the convenience and safety of the travelling public, much will have been done; but we fear that it is extremely doubtful whether our legislators will do so, unless the people outside the walls of Parliament agitate the question, for it must be remembered that that august assembly contains a large number of men who are said to represent the railway interest, which really means, first and foremost, the interests or supposed interests of railway directors, who are very watchful to prevent any measures being adopted which will cause the railways any expense or trouble that can in any way be avoided. They heed not the widows' groans or the orphans' tears, and justify their course of action by the plea that they are protecting the *purses* of railway shareholders, blinding their eyes and closing up their minds against any consideration of the fact that the amount of money annually paid as compensations for accidents, by the shareholders, is far in excess of the sum that would be necessary to put in operation and keep at work many accident-preventing inventions.

We have recommended stringent enactments to be made for compelling railway boards to provide efficient machinery for the prevention of railway accidents, and have mentioned the hanging of directors as one plan that might be adopted as a preventive measure; but there is another plan which was, we believe, some years ago proposed by our facetious contemporary, *Punch*, which was that a railway director should be compelled to accompany each passenger train, sitting in front of the locomotive engine. This may be joking, but all we can say is, that somehow or other the lives and limbs of railway travellers must be protected, and that it is evident that mere solicitation is of no avail for bringing railway directors to a sense of their duty in the matter; and if we can effect this we care not a jot about the exact character of the means made use of for securing such a much-to-be-desired result.

Reviews.

Life of Richard Trevithick, with an Account of his Inventions. By Francis Trevithick, C.E. Illustrated with Engravings on Wood, by W. J. Welch. 2 Vols. London: E. & F. N. Spon, 48, Charing Cross; New York: 446, Broome Street. 1872. Second Notice.

We have already designated this as a most pleasing and instructive work, and as we read on get more confirmed in this view of it, for it is not only a pleasant biography but is likewise a descriptive history of the various important inventions with which its hero was connected.

The name of Richard Trevithick deserves to be always placed alongside that of James Watt, for as the originator of inventions of the highest importance to our national progress, the impulsive Cornishman was quite the equal of the canny Scot; and there is the more propriety in keeping up the memory of the Cornishman, inasmuch as, unlike Watt, he never received the reward of merit, living as it might be said from hand to mouth, and dying in poverty. In fact, his life was an exemplar of the fate too often the lot of the inventor when he does not happen to be also a man who can look sharp after the money, as is frequently the case.

Richard Trevithick, jun., was born on the 13th of April, 1771, under the parental roof, in the parish of Illogan, county of Cornwall. His birth*place* is now a double cottage, around which clouds of mineral sand from the surrounding mine-works float in the wind, depositing layers of pounded rock on everything in house and garden. A hundred years ago it was the manager's residence, delightfully situated at the foot of the north-west slope of Carn Brea Hill, with its ancient castle and Druidical legends. It is in the centre of the famous old and rich mines of Dolcoath, Cook's Kitchen, Pool, Tin Croft, and Roskear, and within a mile of each of them.

He was the first surviving son of five children, and was the mother's pet. Shortly after his birth the family removed a few miles to a leasehold of Penponds, near Camborne. His mother's wedding-ring, which the writer has just placed on his finger, is seven-eighths of an inch internal diameter, and weighs a quarter of an ounce. On the inside of the ring are the words, "God above, increase our love." The letters are not engraved, but indented with a common chisel, probably the lover's handiwork. The boy's first and only school was in the adjoining small town of Camborne, the master reported him a disobedient, slow, obstinate, spoiled boy, frequently absent, and very inattentive. Stories are told of his remaining by himself for hours, drawing lines and figures on his slate in place of the school lesson.

His school attainments were limited to reading, writing, and arithmetic. The master once said, "Your sum may be right, but it is not done by the rule." Trevithick replied, "I'll do six sums to your one." His father wished him to sit at the office desk in one of the mines, but he chose to wander through the mines by himself, holding little converse with others, but well able to defend himself in case of attack.

A difficulty among mine agents about some underground levels led young Trevithick to offer to correct the error. Old heads disapproved at first, and then allowed him to try his hand. Genius enabled him to comprehend the rude surveying instruments of that day, and the untrustworthy character of the magnetic needle when near iron tools or machinery; and he laid down a course which was successfully followed where older heads with more experience had failed.

A letter, written in 1845 by Captain Henry Vivian, describes Trevithick and his partner in connection with the first high-pressure steam-engines.

"My father was a man of great inventive and arithmetical powers of mind; he has often made up the duty of an engine while we have been walking the road together, multiplying six figures by four figures, and giving the answer without aid of pen or paper, by retaining the figures in memory.

"Mr. Trevithick was a man of still greater powers of mind, but would too often run wild, from want of calculation. They did well together, but badly when separated."

Among the traditions of Trevithick, a favourite one is the story of a mine account, at which the mine agents and adventurers met, and after settling the accounts partook of a good dinner and mine-account punch, followed as a matter of course by rough jokes, which passed freely in those times. Captain Hodge, a large, strong man of six feet in height, ventured on a little friendly tussle with Trevithick. Hodge was seized by the middle, and turned upside down; the print of his shoes being left in the ceiling of the room. What a jolly roar of laughter burst from those originals! That account-house in Dolcoath was allowed to stand for many years as a memento of his great strength. He threw a sledge-hammer, they say, 14 lbs. weight, over the engine-house chimney, but the writer's informant could not tell him the height; some said it never came down again.

The author recounts many more *on-dits* as to Richard Trevithick, for which our readers must themselves consult these volumes. The impetus to his inventive talent appears to have been given by the stoppage of one of Boulton and Watt's engines having occurred at Wheal Treasury Mine.

The engineman in charge could do nothing with her, the water was rising in the mine; when Trevithick, jun., offered his services, and made things right. His father boasted that the best man in the mine could not do what his boy had done.

There is no record of the particular kind of engine then erected by Trevithick; he was not, as has been stated, in partnership with Bull, jun., for during the three years the monthly saving in coal by his engine and the entries to Bull are quite distinct, and also their monthly payment as engineers keeping the engines in order. They both strove to avoid Watt's patent claims by combinations and improvements, especially by an engine since known as Bull's. A drawing made by Trevithick probably in those early days represents this kind of engine, which remained in use in Cornwall for many years; several are at work in the London water-works, and one or two at Battersea at the present moment.

This double-acting engine has never received its fair share of credit, for as compared with its rival, the Boulton and Watt patent engine, it is more simple, and less costly—matters of more importance then than now. The doing away with the heavy beam and parallel motion, the placing the injection-valve in the exhaust-steam pipe, thereby avoiding the larger and separate condensing vessel used by Watt, and the double-acting air-pump, were bold and successful ideas, easy of construction, economical in operation, and widely different from the Watt engine.

This seems to have been Trevithick's first act of opposition to Watt, and it was the commencement of a great deal of very close fighting with that great inventor—contests which at first sight would appear to be wholly inexcusable; but on full consideration of the case, however, a more lenient view will we think be adopted. The Cornishmen had long been using the steam-engine (the atmospheric of Newcomen), and Cornish engineers were many of them making improvements upon that cumbrous piece of mechanism, and probably had almost arrived at a knowledge of devices closely approximating to those invented by Watt; hence were inclined to undervalue his ingenuity in perfecting the steam-engine, feeling that they had themselves approximated very closely to his inventions.

The first step taken by Trevithick was one in which the question of priority of invention between himself and Watt is fairly raised regarding the steam whim-engine, of which Trevithick believed himself to be the originator; but the real state of the case seems according to William Pooly, working in Dolcoath, to be this, for he says:—

"I worked in this mine, in 1816, a whim-engine, which they used to say was first put up in Wheal Maid, in Gwennap, by Boulton and Watt. I never heard what date it was; but people said it was the first steam-whim; that she was sent from Gwennap to Wales, and when Boulton and Watt were at the Herland mine with their engines, she was brought back from Wales and tried at Herland; she was moved from Herland and tried at Dolcoath, about 1816, when I worked her; she worked with the old Boulton and Watt hearse-boiler. Several of Captain Trevithick's high-pressure whims were before that working close by, some condensing and one or two puffers. Captain Trevithick's boiler was like a cast-iron cylinder, with the fire-door in one end and the steam-cylinder in the other end; two rods standing out from the cylinder end for guides, and a connecting rod going to the crank."

These facts raise a question of much interest in ~~meting out the just reward of~~ praise to the improvers of the rotary steam-engine.

Did Trevithick construct the first engine using a crank in Cornwall; and had he ever seen an engine with a crank before that of his own construction?

Watt's Wheal Maid failure, a low-pressure steam vacuum engine, erected about 1784, with sun-and-planet wheels, may be taken as the first rotary engine in Cornwall. Trevithick was a boy, and neither saw it nor heard of it; and, moreover, it had not a crank, neither did the crank form a part of the steam-engine for some years after that date, and it certainly was not seen in Cornwall until Trevithick constructed his high-pressure steam models, working with a crank, in 1796. He had never been out of the county until about that time, when he went to London to give evidence in the Watt Patent law-suits. He probably heard of the crank disputes between Watt and Wasbrough, but the crank could not then have been in extensive use as a part of a steam-engine, and may never have been seen by Trevithick.

One of these mementoes of Trevithick's practical genius in 1800 still worked at Cook's Kitchen Mine in 1869.

We turn with pleasure from these equivocal matters to a subject freed from the embarrassments they create— Trevithick's connection with the Camborne common road locomotive. The late Mrs. Trevithick frequently spoke of models of her husband's early engines, the first of which worked at her house in Camborne, about the year 1796 or 1797. It was made by Mr. William West, and was to have been shown in the law-suits between Boulton and Watt and the Cornish engineers.

Lord and Lady Dedunstanville, the large landed proprietors in the mining district—embracing Dolcoath, Cook's Kitchen, Stray Park, and many more of the early Cornish mines—and Mr. Davies Gilbert, a friend of Trevithick's, came to her house to see the model work.

A boiler, something like a strong iron kettle, was placed on the fire; Davies Gilbert was stoker, and blew the bellows; Lady Dedunstanville was engine-man, and turned the cock for the admission of steam to the first high-pressure steam-engine. The model was made of bright brass.

Shortly afterwards another model was made, which ran round the table, or the room. The boiler and the engine of this second model were in one piece; hot water was poured into the boiler, and a red-hot iron put into an interior tube, just like the hot iron in tea-urns.

In a third model the boiler was heated by a spirit-lamp. This one was taken to London by a gentleman who came down for the purpose of seeing it work.

A model of Trevithick's, now in the Kensington Museum, spoken of by Mr. Redford as having come from the engine-works of Messrs. Whitehead and Co., Soho Iron Works, Man-

chester, is probably one of those spoken of by Mrs. Trevithick as having been made prior to 1800. It is a perfect specimen of a high-pressure steam-engine, with cylindrical boiler, adapted to locomotive purposes. It served as a guide to Messrs. Whitehead and Co., who manufactured engines for Trevithick in 1804.

An actual locomotive was constructed, and in 1801 Trevithick was in London about the patent, and in Merthyr Tydfil and Coalbrookdale. The accounts do not enable us to trace the time occupied in building the first steam-carriage, or the necessary alterations during its construction. It was in progress in 1800; and on Christmas-eve, 1801, conveyed the first load of passengers ever moved by the force of steam.

The start was from Tyack's smiths' shop, where the smaller parts had been made. East and west ran the great main coach-road to London, on which the Cornish coach, at that time a van or covered waggon, conveyed the few who travelled on wheels. Northwards, towards the great house of Lord Dedunstanville, at Tehidy, the road was more hilly. The south road was a rude country lane, in the worst possible order, with a sharp curve at the commencement, and steeper gradients than either of the other roads.

As an indication of the greater difficulty of constructing an engine at that time in Cornwall, thirty years later, when the writer worked in Harvey's engine-factory at Hayle, in the building in which William West had constructed parts of the Camborne locomotive, there were but a few small hand-lathes fixed on wooden benches, a few drilling machines, and but one chuck-lathe. Arthur Woolf was the engineer, and the writer his pupil, and served under the shop foreman, Jeffry, whose father had worked on the Camborne locomotive, and on the Jeffrie and Gribble engine at Dolcoath.

The following statement was given by old Stephen Williams:—

"I knew Captain Dick Trevithick very well; he and I were born in the same year. I was a cooper by trade, and when Captain Dick was making his first steam-carriage I used to go every day into John Tyack's blacksmiths' shop at the Weith, close by here, where they put her together.

"The castings were made down at Hayle, in Mr. Harvey's foundry. There was a deal of trouble in getting all the things to fit together. Most of the smiths' work was made in Tyack's shop.

"In the year 1801, upon Christmas-eve, coming on evening, Captain Dick got up steam, out in the high-road, just outside the shop at the Weith. When we see'd that Captain Dick was agoing to turn on steam, we jumped up as many as could; may be seven or eight of us. 'Twas a stiffish hill going from the Weith up to Camborne Beacon, but she went off like a little bird.

"When she had gone about a quarter of a mile, there was a roughish piece of road covered with loose stones; she didn't go quite so fast, and as it was a flood of rain, and we were squeezed together, I jumped off. She was going faster than I could walk, and went on up the hill about a quarter or half a mile farther, when they turned her and came back again to the shop. Captain Dick tried her again the next day; I was not there, but heard say that some of the castings broke. Recollect seeing pieces of the engine in the ditch years afterwards, and suppose she ran against the hedge."

In the same year Mr. Newton informed the writer "that he knew Mr. Trevithick well, and was to have been his pupil in engineering. He rode on the engine the first evening it was tried. It went half a mile up a steep hill, and then returned to the workshop [we stood on the very ground while Mr. Newton told his story]. The fire was blown by a double-acting bellows, worked by the engine. Was well acquainted with Murdoch and his friends in Cornwall, but never heard he had made a locomotive, or that Trevithick had been his pupil. The engine was called Captain Dick's puffer, from the steam and smoke puffing out of the chimney at each stroke of the engine."

"Captain Nicholas Vivian saw the Camborne steam-carriage, and was familiar with the stories of the early trials, as his friends and relatives were interested in it. It ran part of the way up the Beacon Hill when first tried. Something went wrong, and it was taken back to Tyack's smith's shop; it worked again after that, but he did not know what was then done with it."

The stiffness on the incline of the Beacon Hill prevented horse-vehicles from ascending at more than walking speed. In the present day it is straightened, but the old boundary-marks are still to be seen of a sharp curve at the commencement of the journey.

This southern road from Camborne was the worst of the four that were open to Trevithick's choice for testing his first locomotive, carrying as many passengers as could find standing-room on it—perhaps half-a-dozen or half-a-score. A piece of newly-made road with loose stones, just where the incline increased, and when the small boiler had expended its hoarded stock of high-pressure steam, heaped an insurmountable barrier against the small wheels of the engine, and baffled the engineer for the moment. While the road was being smoothed, the steam had increased its elastic force. Another progress was made, and the first half-mile had been travelled on a steam-horse.

The incline was still increasing, almost up to the steepness of the famous Mont Cenis, of 1 in 15 or 20, when the engineer was again beaten, and stuck fast. [illegible] Christmas-time; rain drenched the [illegible] and cooled the [illegible] and coming darkness added to the gloom. The engine was turned about, and safely conveyed the passengers back again, down this dreadful circuitous hill, to the starting-point at Tyack's smiths' shop.

A second locomotive was tried in Camborne in the latter part of 1802 or commencement of 1803, and was sent to London in January, 1803. William West was then at Harvey's foundry in Cornwall, preparing a new cylinder, and still in February and March he was there preparing a new boiler, after which he was for five months in London, about the steam-carriage; and in August Felton was paid for building the coach.

The London locomotive of 1803 was a great improvement on the former ones: it was not so [illegible] and the horizontal cylinder, instead of the [illegible]cal, added very much to its steadiness of motion, while wheels of a larger diameter enabled it the more easily to pass over bits of bad road, which had brought the Camborne one to a standstill. The boiler was wholly of wrought-iron, and with the engine attached to it, was put together at or near Felton's carriage shop in Leather Lane; Trevithick, Andrew Vivian, and William West were with it, and Arthur Woolf (then in Trevithick's pay with the first high-pressure sent to London) came to see what was going on.

Andrew Vivian ran it, one day, from Leather Lane, [illegible]ray's Inn Lane, on to Lord's Cricket Ground, to Paddington, and home again by way of Islington—a journey of half-a-score miles through the streets of London. Trevithick was not on the engine on that occasion. Andrew Vivian was not an engineer, and would not have ventured on so long a run had there not been prior proof of what the engine could do; and the fact of an altered cylinder and boiler having been under construction in Cornwall after the locomotive had been sent to London, proves that several trials had been made and changes found necessary.

"Captain Joseph Vivian recollects that about 1803 his father, then a captain of a vessel, on his return from London told them that he and his nephew, John Vivian, had been invited to take a bit of a drive with Captain Trevithick and Captain Andrew Vivian on their steam-carriage: they went along pretty well through a good many streets, and were invited again for the next day; but Captain Vivian thought he was more likely to suffer shipwreck on the steam-carriage than on board his vessel, and did not go a second time.

"Captain John Vivian, H.M.P.S., was, about the middle of 1803, on board his uncle's vessel in London, and often went to see the steam-carriage putting together at a coach-builder's shop in Leather Lane. Captain Trevithick and Captain Andrew Vivian were there, and Mr. William West was the principal man in putting the engine together. Mr. Arthur Woolf frequently came in, he being engaged close by as an engineer in Meux's brewery.

"Thinks the engine had one cylinder and three wheels; the two driving wheels behind were about 8 feet in diameter. The boiler and engine were fixed just between those wheels. The steering wheel was smaller, and placed in front. There were some gear-wheels to connect the engine with the driving wheels. The carriage for the passengers would hold eight or ten persons, and was placed between the wheels, over the engine, on springs. One or two trips were made in Tottenham Court Road and in Euston Square. One day they started about four o'clock in the morning, and went along Tottenham Court Road, and the New Road, or City Road; there was a canal by the side of the road at one place, for he was thinking how deep it was if they should run into it. They kept going on for four or five miles, and sometimes at the rate of eight or nine miles an hour. I was steering, and Captain Trevith[illegible] and someone else were attending t[illegible] the [illegible] Captain Dick came alongside [illegible]d, 'She is going all right.' [illegible] I think we had better go on to [illegible] She was going along five or six miles an hour, and Captain Dick called out, 'Put the helm down, John!' and before I could tell what was up, Captain Dick's foot was upon the steering-wheel handle, and we were tearing down six or seven yards of railing from a garden wall. A person put his head from a window, and called out, 'What the devil are you doing there! What the devil is that thing?'

"They got her back to the coach factory. A great cause of difficulty was the fire-bars shaking loose, and letting the fire fall through into the ash-pan.

"The waste steam was turned into the chimney, and puffed out with the smoke at each stroke of the engine. When the steam was up she went capitally well, but when the fire-bars dropped, and the fire got out of order, she did not go well.

"I heard afterwards that the framing of the engine got a twist, and she was used to drive a mill for rolling hoop-iron, and also that she ran on a tramroad laid down in Regent's Park."

"In 1860, Mrs. Humblestone recollected Mr. Trevithick's steam-carriage go through Oxford Street; the shops were closed, and numbers of persons were waving handkerchiefs from the houses; no horses or carriages were allowed in the street during the trial. The carriage moved along very quickly, and there was great cheering. At that time she kept a shop next door to the Pantheon, and it, like the others, was closed. Her husband was employed with Mr. Trevithick at the Blackwall dredgers or the tunnel."

The reader must not imagine that these few records collected of events witnessed by but very few who still live nor that the slight notice to be found of them in written history are indications of their want of importance, or of their having been mere passing experiments. They were the first and firm steps of the young locomotive, which Trevithick laboured for years to strengthen and make useful, and which would have given to our fathers some of the benefits we receive from steam locomotion had they had the good sense to comprehend Trevithick. Two years of locomotive experiments in Cornwall were followed by six or eight months of trials in the streets of London, commencing with January, 1803, when the locomotive was forwarded from Cornwall.

Trevithick, genuine inventor as he was, stopped not at common road locomotives. He constructed a tram and railway locomotive, but these not proving a commercial success he turned his attention to the construction of a high-pressure steam-dredger.

Whilst dredging in the Thames, the Thames Archway Company were anxiously seeking new plans and a new engineer. Not being satisfied with the proposals of Mr. Rennie and Mr. Chapman, they sought out Trevithick, who soon found himself in a position most trying and unsuitable to his energetic temperament.

"At an annual meeting of the proprietors on the 4th of May, 1808, the directors refer to their second meeting in June, 1805 'That it appears to this meeting that the well constructing the driftway is of the highest importance in the future progress of the works, involving in it the success or failure of the undertaking.

"'That, therefore, the works relating to the driftway be suspended until the opinion of a professional man of eminence be taken on the various matters respecting it.'

"Mr. Rennie and Mr. Chapman were accordingly consulted; but as their opinions did not coincide, nor, indeed, were stated upon all the points on which the directors chiefly wished for information, they felt themselves bound to resort to some other source; and Mr. Trevithick was introduced to them by their resident engineer, Mr. Robert Vazie, as a person skilled in mining. After a due examination into his character, as appears by the minutes of the directors, and having received the strongest testimonies in his favour from several quarters as to his skill, ingenuity, and experience, the directors were induced to contract with him for superintending and directing the execution of the driftway, such as he proposed it to be; for which they agreed to pay him £1000 provided he succeeded in carrying it through to the north shore; or £500 if the directors ordered it to be discontinued in the middle, which they reserved to themseves the power of doing; but to receive nothing in case he did not succeed.

"The driftway was accordingly commenced on the 17th of August.

"On the 5th of September following Messrs Vazie and Trevithick, in a joint report to the directors, strongly recommended the immediate purchase of a 30-horse power steam-engine. The directors did accordingly purchase the same, and it is now ready to work. The driftway proceeded till about the beginning of October, when it appeared that the works had been very considerably interrupted and delayed in their progress. The directors therefore, on the 8th October, resolved to institute an inquiry into the cause; and the consequence of this investigation and disclosure of facts was the removal of Mr. Robert Vazie from his office as resident engineer on the 10th October, by which time the drift had been extended 394 feet—that is, at the rate of 6 feet 2 inches per day through a dry sand.

"The works now proceeded without embarrassment, and with considerable less cost; as from this time (the 19th October) to the 29th November, the ground continuing as nearly as possible of the same quality, it was extended 421 feet, or 11 feet 2 inches per day, which is nearly a double rate (deducting three days and a quarter that the works were suspended while the directors determined on the turn the drift should take).

"From the 29th November to the 19th December the drift was extended only 138 feet, or 6 feet 10 inches per day, in consequence of the drift now running in a stratum of rock, great part of which was so hard that it could not be broken up without the use of chisels and wedges.

"By the 21st December the drift had proceeded 947 feet from the shaft; and it was observed that the strata through which it passed dipped to the northward about 1 foot in 30, in consequence of which the rock that at one time formed the whole face of the breast now only reached within 2 feet of the top, and which was occupied by a sandy clay, mixed with oyster and other shells, and containing some water.

"On the 23rd, notwithstanding the workmen were proceeding with the utmost precaution, the roof broke down and discharged a great quantity of water from a quicksand, which was afterwards ascertained to be about 5 feet 6 inches above the roof.

"By the 26th January the drift was extended 1028 feet, having been worked through a considerable part of the quicksand; and at this period the river made its way into the drift by a fall of earth, which made a considerable orifice in the bed of the river, which has been filled up at several times with earth carried there for that purpose, and the drift has since then been extended to 1040 feet, which is the present length of it.

"Resolved, that the money paid or claimed by the engineers, Mr. Rennie, Mr. Wilcox, Messrs. Stobart and Buddle, Mr. Thomas Cartwright, Mr. James Barnes, and Mr. William Chapman, whom the directors have consulted with as to the prosecution of the works, be allowed.

"Resolved, that Mr. Richard Trevithick be, and is hereby appointed, engineer to the said company, and be directed to proceed forthwith with the works."

At the second meeting of the proprietors in 1805 differences had arisen between the directors and their engineer, Mr. Robert Vazie, on the method of constructing the driftway. Mr Rennie and Mr. Chapman were called in to advise a plan for the guidance of the directors. Their advice was not approved of, and after much delay Mr. Vazie introduced to their notice Mr. Trevithick as a skilful miner and engineer. This was about the middle of 1807. On the 10th August, 1807, the directors engaged with him to make the proposed driftway from the south shore of the Thames, at Rotherhithe, to half-way across the river, from which central point it was contemplated to commence forming the permanent tunnel, of the size to be then determined, either for foot-passengers alone, or if the nature of the work gave promise of success to enlarge it sufficiently for the passage of carriages

"Limehouse, August 11th, 1807.

"Mr Giddy,—Sir,—Last Monday I closed with the tunnel gents. I have agreed with them to give them advice, and conduct the driving the level through to the opposite side (as was proposed when you attended the committee): to receive £500 when the drift is halfway through, and £500 more when it is holed on the opposite side. I have written to Cornwall for more men for them. It is intended to put three men on each core of six hours' course. I think this will be making £1000 very easily, and without any risk of loss on my side. As I must be always near the spot to attend to the engines on the river, an hour's attendance every day on the tunnel will be of little or no inconvenience to me. I hope nine months will complete it. From the recommendation you gave me they are in great hopes that the job will now be accomplished; and, as far as Captain Hodge and myself could judge from the ground in the bottom of the pit, there is no doubt of completing it speedily. I am very much obliged to you for throwing this job in my way, and shall strictly attend to it, both for our credit as well as for my own profit.

"I am, Sir, your very humble servant,
"Rd. Trevithick."

Within a week of his engagement he had commenced the driftway. The sinking of the shaft on the south shore, from the bottom of which the driftway was to commence, was the extent of progress during the two or three years before Trevithick's appointment. It was 68 feet 4 inches in depth from the surface; a wooden platform a slight distance above the bottom of the shaft served to form a reservoir for the drainage water from the drift, from which it was pumped to the surface by a steam-puffer engine. The bottom of the drift was even with this platform. In size it was sufficient only for the passage of a workman with his barrow, being 5 feet high, 3 feet broad at the bottom, and 2 feet 6 inches at the top, inside measurements; the four sides were kept in form by woodwork and strong 3-inch planking. The working end required great care, and frequently the application of close planking across the end or face of the work to prevent a sudden fall of water and sand. As the drift proceeded, the increasing quantity of water and earth or sand to be raised to the surface led the two engineers, Vazie and Trevithick, to make a joint report recommending a 30-horse-power steam-engine. Before two months had passed this joint engineering broke down, and Trevithick was left to carry out his own plans on the work, but subject to annoying remarks from without.

After a while difficulties occurred which ultimately led to Trevithick's disconnection with the matter. Upon this he turned his attention to the construction of iron tanks, for which he took out a patent in conjunction with Dickinson, 31st October, 1808. Then he gave his attention to the construction of ships of wood and iron, as to which the following statements are worthy of notice.

A memorandum in Trevithick's writing, without date, but evidently of about the period of the patent of 1809, gives his views of the detail of an iron sailing-ship. The necessary calculations for the parts are jumbled up with the writing as he proceeds with the description. Unfortunately the drawing he refers to has disappeared. The vessel was for a trader, carrying 800 tons, drawing 8 feet 3 inches. The length 70 feet, width 35 feet, depth of hold 10 feet. The keel 1 inch thick, the vessel's bottom ¾ of an inch thick, the sides ½ an inch, the deck ⅜ths of an inch, and the gunwale ½ of an inch thick, the whole riveted together and strengthened with iron ribs in the hull. Three iron keels of 2 feet in depth and 2 feet apart gave strength to the bottom and helped sailing qualities on the wind, while the great breadth enabled her to carry canvas without taking ballast. The weight of the vessel was 70 tons. The masts and yards were wrought-iron tubes, the shrouds and stays were iron chains; each of the two masts was supplied with a square sail 50 feet high by 44 feet wide, its larger half being aft of the mast, as a lug sail. This aft or long end of the fore-yard was connected by a chain with the fore or short end of the yard on the main-mast, thus making the two sails balance one another to save labour in trimming them.

The yards were centred on the masts, and could be lowered down, while the sails fixed to the yards reefed themselves by rolling on the yards as a roller-blind. Studding sails had two-thirds the spread of the square sails, the yards for which slid into the hollow main-yards when not wanted. Such an iron vessel would not disgrace a builder of the present day. The peculiarity of reefing by rolling on the yard has since been tried with some success.

The pamphlet of 1809 thus speaks of the tubular iron mast, and establishes the date of the drawing and memorandum referred to:—

"Sliding tubular masts, made of iron, and so constructed that the upper ones slide into the lower in a manner somewhat like a pocket-telescope.

"A model of one for a first-rate ship, on a scale of one-eighth of an inch to a foot, is now ready for inspection.

"This tubular mast, being half-an-inch thick, and the same height and diameter as a wood mast, will be lighter, considerably stronger, much more durable, and less liable to be injured by shot, and will cost less money.

"This mast is made to strike nearly as low as the deck, to ease the ship in a heavy sea. Yards and bowsprits may also be made of wrought iron, and chain shrouds and chains will not cost half the expense of rope."

The description in Trevithick's handwriting gives such close detail, that a practical foundation of constructing such a ship of iron, with tubular masts and yards and self-reefing sails,

was certainly made public, if not really acted on in 1809, as is evidenced by the workman-like grasp of the whole design, expressed in few words, interspersed with calculations establishing his practical deductions, resulting in the greater speed, carrying power, and economy of management of iron sailing-ships as compared with wooden sailing-ships.

The figures in his detail description are omitted, as the calculations were frequently broken off, when he mentally saw the approximate result.

"A plan, side and cross section of a wrought-iron trading-ship. Scale one-sixth of an inch to a foot.

"Vessel to be 70 feet long, and 35 feet wide on the deck, and 10 feet deep in the hold, with three iron keels of 2 feet wide, with iron rods for strengthening the hull, the whole riveted together the same as a steam-engine boiler; the keel to be 1 inch thick, the bottom three-quarters thick, the sides half-an-inch thick, the deck three-eighths thick, and the gunwale one quarter of an inch thick. The masts and yards wrought-iron tubes, and the shrouds and stays iron chains.

"Weight of the ship 70 tons, width of the sails 44 feet by 50 feet high, two-fifths before the mast, and three-fifths aft the mast.

"Studding sails two-thirds of the width of the large sail. Deep water-line with 300 tons, 8 feet 3 inches, including the keels of 2 feet in depth.

"The yards fall down near the deck, and the sails reef themselves without going aloft, and are always drawn tight in a chain frame that holds the sails close to the wind and prevents their flopping.

"The yards being centred on the masts, and the after-end of the fore-yard chained to the fore-end of the after-yard, balances the sails, that they go about easily.

"The iron keels act as ballast; and, together with the extreme width of beam, enable the required canvas to be carried without taking in additional ballast. This vessel would be lighter, sail faster, stow more cargo, be more durable, and worked with a less number of hands than a wood vessel."

The news of the day describes a race between the English yacht *Livonia* and the winning American yacht *Columbia*, a large centre board schooner, built in 1871, 98 feet long, 26 feet beam, 8½ feet hold. Trevithick's iron trader of 1809 was 70 feet long, 35 feet beam, 10 feet hold, to which add the sliding keels, described in the following chapter; and the two schooners, allowing for the different requirements of racer and trader, exhibit similar general principles, though the vessel of sixty years ago had spars and hull of iron.

From the time of his work on the Dredger in 1803 to his leaving London in 1810 his occupations caused him to be almost daily within sight of the ships and mercantile operations on the Thames—iron buoys, iron tanks, iron docks, iron steamboats, iron sailing-vessels, iron fighting ships, designed, patented, and more or less brought into commercial use, were results of those seven years of labour.

Our small and imperfect knowledge of Richard Trevithick has caused him to be regarded merely as the inventor of the high-pressure steam-engine, while in truth that one machine, among his numerous useful discoveries, was but as a foot or hand to a perfect man; just as it took its place of relative usefulness in the improved sailing-ship made of plates of iron, giving greater safety and comfort to the sailor, reducing his labour by the use of sliding keel, water ballast, and self-reefing sails; the steam-engine giving auxiliary propelling power, discharging cargo, and weighing the anchor, while the steam-boiler gave facilities for cooking food, and the iron tanks a larger supply of more wholesome water.

"Many men scheme, take patents, and are no more heard of. Trevithick's working models, made known by his written description, show on what a different basis his schemes were built. Every detail is practically described, as though it was a history of a thing of the past rather than of a thing to come.

After a lapse of sixty years the greater portion of those schemes have bec[illegible] realities; a paper of the day (*The* [illegible] *Morning News*, October 26th, 1871) [illegible] great increase of iron steamships, state[illegible] "about £11,000,000 worth of shipping is [illegible] in course of building"; and this [illegible] branch of nat[illegible]l prosperity took its rise from the designs that we have tra[illegible] their original working form in 1809 [illegible] sliding tubular masts and yards rema[illegible] be made practicable.

Trevithick afterwards exercised his ingenuity in the subject of propelling vessels by steam.

Those traces of proposals to propel vessels by [illegible] high-pressure steam-engines, in 1804, to destroy the French fleet in Boulogne Harbour, show him as the pioneer of marine engineers. A messenger from a marquis—"a profound secret"—caused a few minutes' cautious reflection and a wish to consult his friend, followed by,—"If you think you could get Government to put it into execution, I would readily go with the engines and risk the enterprise." He thought it possible with these engines to drive ships into the middle of the fleet, and was prepared, without a moment's delay, to place two of them in a vessel, and by them propel her to France.

Within a fortnight he was at Trentham Hall, plotting with the Marquis of Stafford, who sent him to London to see Lord Melville and Mr. Pitt. He gav[illegible] thought to this compo[illegible] of propelling a vessel by steam, stee[illegible] without a helmsman, and exploding it at the required moment for he admits, "I am not master of myself." Probably this was the only time in his life that he doubted his ability to make his high-pressure steam-engine do everything.

"Soho Foundry, Manchester,
"January 10th, 1805.

"Mr. Giddy,—Sir,—I have answered Mr. Grundy's letter. Their engine will cost about £170, and will draw one hundred kibbals with about three bushels of coal.

"I fear that engine at Dolcoath will be a bad one. I never knew anything about its being built, until you wrote to me about Penlerthy Croft engine, when you mentioned it.

"I then requested Captain A. Vivian to inform me the particulars about it, and I find that it will not be a good job. I wish it never was begun. I was sent from the Marquis of Stafford to Lord Melville. I was at the Admiralty Office, and was ordered to wait a few days, before they could say to me what they wanted. I called five or six days following, but never received a satisfactory answer, only to still wait longer. But I left them without knowing what they wanted of me, for I was tired waiting, and was wanted much at Coalbrookdale at the time. When they send for me again they shall say what they want before I will again obey the call. There was an engine, a 10-inch cylinder, put into a barge to be carried to Macclesfield, for a cotton factory, and I tried it to work on board. We had a fly-wheel on each side of the barge, and a crank-shaft across the deck. The wheels had flat boards, 2 feet 2 inches long and 14 inches deep, six on each wheel, like an undershot water-wheel. The extremity of the wheels went about 15 miles per hour. The barge was between 60 and 70 tons burthen. It went in still water about 7 miles per hour. This was done to try what effect it would have. As we had all the apparatus of old material at the Dale, it cost little or nothing to put it together.

"I think it would have been driven much faster with sweeps.

"The engine that was made for the London Docks, for discharging the West Indiamen, is put to work in a manufactory. They would not permit fire within the walls of the dock; there is an Act of Parliament to that effect.

"There is a small engine making in Staffordshire for the London coal-ships to carry with them for unloading.

"The boiler is 2 feet 6 inches diameter and 5 feet long, with the cylinder horizontal on the outside of the boiler. The cylinder 4 inches in diameter, 18-inch stroke. I think it will be equal to six men.

"The engine will always go one way. The man that stands at the hatchway will have a string to throw out a catch, which will let the barrel run back with the empty basket.

"I shall go to Newcastle-on-Tyne in about four weeks, and most likely shall return to London. By that time the little engine will be sent to London for the coal-ships. A great number of my engines are now working in different parts of the kingdom. There are three foundries here making them.

"They finish them in very good style; all the wrought iron is polished, and ornamented with brass facings. They are the handsomest engines I ever saw. I expect there are some of the travelling engines at work at Newcastle. As soon as I get there I will write to you.

"This day I received a letter from Jane [his wife], sad lamentations on account of my absence. I am obliged to promise to return immediately, but shall not be able to fulfil it at this moment. I should be wrong to quit this business, as there are now seventeen or eighteen foundries going on with those engines, and unless I am among them the business will fall to the ground, and after such pains as I have taken I am sorry to quit it until I [illegible] I am sorry to hear that [illegible] go to London to reside, [illegible] will now spend but a small par[illegible] in Cornwall, and I shall be deprived of your good advice in future.

"I am, Sir, your very humble servant,
"Richard Trevithick."

This account of a 60 or 70 ton barge, driven by a high pressure steam puffer engine, having a cylinder 10 inches in diameter, at a speed about seven miles an hour, the float-boards going at fifteen miles an hour, proves that had Lord Melville spared five minutes out of that week to keep his appointment with Trevithick the first steam fire-ship would have dated from 1804; for within three months from that time he had driven a barge at a speed of seven miles an hour by an engine that had been constructed for another purpose, and was adapted to the steamboat on the spur of the moment by a crank shaft across the deck, having at each end a paddle-wheel, with six paddle-boards 14 inches deep by 2 feet 2 inches long.

Trevithick's steamboat was an ordinary canal barge, into which one of his steam engines had been placed as goods for conveyance to Manchester from Coalbrookdale, as mentioned in his note of the 5th of October, 1804, and 10th January, 1805. The fact came under the notice of the Prime Minister, and the makers of the engine were among the best-known manufacturers of the day, yet no one has recorded that Trevithick constructed this first practical steamboat.

Napoleon I. is said to have exclaimed, about 1804, when reviewing his army and ships at Boulogne, "The English do not know what awaits them; if we are masters of the Channel for a few hours England has lived her time." Napoleon certainly did not know of Trevithick's proposed steam fire-ships, or of his courage in offering to guide them into the middle of his fleet.

Lord Dedunstanville had formed a troop of Cornish volunteers to drive Napoleon from the shores, and among them was Trevithick, who, his wife said, appeared well pleased with his red coat. One night a beat of drums in the Camborne streets startled the sleepers; Trevithick awoke his wife, and asked what all the noise could be about. "Oh! I suppose the French must be come; had you not better put on your red coat and go out?" "Well, but Jane," suggested the volunteer, "you go first and just look out at the window, to see what it is!"

"Blackwall, July 23rd, 1806.

"Mr. Giddy,—Sir,—This day I got th[illegible]

engine to work on board the *Blazer* gun-brig.

"It does its work exceedingly well. We are yet in dock, and have lifted up mud only. I hope to be down at Barking shaft in a few days, at our proposed station, when I will write to you again. I think there is no doubt of success.

"A gentleman has ordered an engine for driving a ship. It is a 12½-inch cylinder. I am at a loss how to construct the apparatus for this purpose; therefore am under the necessity of troubling you for your advice on the subject.

"The plan I have is as under, unless you condemn it, or suggest a better plan. I propose to put a horizontal engine below the deck, and to put a wheel of 14 feet diameter in the hold. This wheel is to work in an iron case, air-tight, the axle to work in a stuffing box, and a pump to force air into this case to keep down the water from flooding the wheel, so that only the floats on the extremity of the wheel shall be in the water, and then only extend about 15 inches below the keel of the ship.

"The cutter is about 100 tons burthen.

"I wish to know the size of the floats on the wheel, and the velocity you think they should be driven.

"I think the power of the engine is equal to 400,000, 1 foot high, in a minute, from which you will be able to judge what size of floats, and, what velocity will be best. The air that is forced into the wrought-iron case will always keep the water down in the case to the level of the bottom of the ship. A space will be left on each side of the wheel, so that the air will never be displaced by the working of the wheel.

"Your answer to this will very much oblige,
"Your very humble servant,
"Richard Trevithick.

"Direct to me at the Globe Tavern, Blackwall, near London."

In 1806 he had undertaken the still difficult task of placing a high-pressure puffer steam-engine of about 12-horse power in a gentleman's sailing-yacht of 100 tons. Side-wheels and paddle-boxes would destroy her appearance and sailing qualities. One centre paddle-wheel, enclosed in an iron case, was therefore to be fixed in the hold, the float-boards passing through an opening in the vessel's bottom. Water was prevented from rising in the case by a pressure of air forced into it by the engine, sufficient to depress it to near the level of the vessel's bottom, that the wheel might not be flooded. The paddle-shaft, where it passed through the two sides of the wheel-case, was made air-tight by stuffing-boxes. The bottom of the float-boards was 15 inches below the keel of the ship, attached to a wheel 14 feet in diameter. The engine to drive it was a 12½-inch cylinder high-pressure puffer direct-action engine, of about 12-horse power, with cylindrical tubular boiler; the general outline of engine and boiler being very like the Newcastle locomotive of 1804.

About that time, while producing changes and improvements in marine propulsion, he became acquainted with Mr. Robert Dickinson, who had been a West India merchant, and they became partners in the patent.

The following reads like an everyday story to those who are acquainted with the lives of inventors.

Everyone thought highly of his inventions, but no one enabled him to bring them into immediate profitable use, such being the inevitable result of going too much in advance of the time. Ten years of incessant labour since his first experiments with high-pressure portable steam-engines to bring them within the range of everyday use had left him a lone man, bereft of liberty and broken down in health and strength.

Steel's letter of the 20th April, 1810, was addressed to Trevithick in Cornwall, where he had gone to raise money by mortgage or sale of mine shares or property, to pay the cost of showing his inventions to the public.

On his return to London everything belonging to him was seized for debt, and he was obliged to retire to a sponging-house in a street of refuge for debtors—a half-way house between freedom and imprisonment.

All this was too much for the strongest man. Typhus and gastric fever during many weeks reduced him to a state of physical helplessness, followed by the loss of intellect and brain fever, and the patient, before so weak, required the care and strength of keepers.

In this emergency Dickinson brought his medical man to assist; Dr. Walford, known to the family, disagreed with the new comer. A third medical man was called in. Anonymous letters were sent to Mrs. Trevithick on the probable result of the injurious medical treatment.

In an emergency, when it seemed a question of life or death with her husband, Mrs. Trevithick, scarce knowing what she did, sought through the streets of London for a medical man. A gentleman observing her need of help asked what was the matter, begged her to at once return to her house, and promised to seek and send a doctor. Misfortune had reached the turning-point. A kind letter from her brother advised Trevithick's return to Cornwall, and in the early part of September, 1810, being still too weak to move hand or foot, he was carried on board a small trading vessel, called the *Falmouth Packet*, his eldest boy, about ten years old, keeping him company.

It was war time, and the *Falmouth Packet* with other vessels sailed from the Downs, under convoy of a gun-brig. After three days they anchored off Dover. Trevithick went on shore and enjoyed the first short walk since the commencement of his illness, four or five months before. On getting under way again they were chased by a French ship of war. The *Falmouth Packet* knew how to sail and when to hug the shore, so she showed her heels to the enemy; and in six days after leaving London landed him at Falmouth, about sixteen miles from his Cornish residence at Penponds. Taking his boy by the hand, they walked to his home, from whence two months before, when too ill to be informed of his loss, his mother had been carried to her grave from the house of his childhood.

The following is worthy of note as referring to eminent men of the present day.

Mr. John Penn, who assisted Mr. Mills in putting together Trevithick's screw-propeller and improved steam-engine, was a millwright, and probably the founder of the present eminent marine engine-building firm, Penn and Sons.

Field, who also helped, has probably since been known as a partner in the firm of Maudslay, Son, and Field, equally eminent with Penn and Sons. Harry Maudslay, also one of the firm, was then known as a clever smith employed by Trevithick.

James Nasmyth, then a boy, working for Maudslay, has since been the maker and patentee of Nasmyth's upright or chimney boiler, for which the writer, who had the pleasure of his personal acquaintance, paid him patent right, though it was almost an exact copy of Trevithick's boiler made and used in 1815, and formed part of the engine that Field and Penn and others, probably Maudslay and Nasmyth, saw and worked on.

In 1833, the writer, seeking his fortune in London, and knowing that Maudslay, then a leading marine-engine builder, had benefited by Trevithick's patent tanks, and steamboat discoveries, and hoping a return for benefits received, sent in his name as the son of Trevithick, the engineer, and asked permission to go through the works. The answer was, "We are very sorry, but it is against our rule"; but he gained admittance by one of the leading mechanics, his relative, school-fellow, and early shop companion, now the leading mechanic in Penn's factory, and the grandson or grandnephew of old Sam Harably, who, as Trevithick's helper, had worked side by side with Penn and Maudslay in putting together the tanks, nautical labourer, and screw-propeller, during 1808 to 1815.

All Trevithick's talent, however, had up to this time brought him to nothing but bankruptcy, and yet he persevered in his inventive efforts. His further labours and vicissitudes we must reserve for another notice of these readable and instructive volumes.

Magnetism and Deviation of the Compass. For the use of Students in Navigation and Science Schools. By John Merrifield, LL.D., F.R.A.S. London: Longmans, Green, and Co. 1872.

The notes of which this work is the enlargement have been used in the author's school for the past ten years; they have now been recast, and are offered to the public to supply the present want, and we consider the work does efficiently supply a public want.

Part I. is intended to cover the ground for the Class Examination in Science Schools; and the whole work should be mastered by candidates in Navigation at the Department Examinations, as well as by intelligent sailors, especially those who intend to present themselves for either the Extra-Master's Certificate, or for the special endorsement on the Ordinary Master's Certificate. When this has been done, the student is strongly recommended to study "Deviation of the Compass," by F. J. Evans, R.N., F.R.S.; "Practical Information on the Deviation of the Compass," by J. T. Towson, F.R.G.S.; "The Admiralty Manual," Parts I. and II.; and "A Treatise on Magnetism," by G. B. Airy, M.A., F.R.S., the last two of which are especially adapted for the mathematical student.

The work contains—Chapter 1: On Magnetic Equator and Axis, How the Poles are found, Position which Free Magnets take, Magnetic Field, Theory of Magnetic Fluids, Coercive Force, Magnetic Induction, Attraction and Repulsion, Magnetic Substances; Chapter 2: On Terrestrial Magnetism, Magnetic Meridian, Magnetic Elements, Variation or Declination, Inclination or Dip, Intensity, Secular Variation, Annual Variation, Diurnal Variation, Instruments used in obtaining Magnetic Elements, Magnetic Charts, Terrestrial Induction, Astatic Needle; Chapter 3: On How Magnets are Made, Method of Single Touch, Separate Touch, Double Touch, By Terrestrial Induction, By Electrical Action, Saturation Point, Armatures, Effects of Heat on Magnets; Chapter 4: Comparison of the Strength of Magnets, By the Deflection of a small Needle, By the Torsion Balance, By the Method of Oscillations, Absolute Unit of Force. In Part 2 the Deviation of the Compass is treated of. Chapter 1 deals with Errors of the Compass, Variation, Deviation, Local Attraction, How a Table of Deviations is formed, By Reciprocal Bearings, By the Bearings of a Distant Object, By Marks on Dock Walls, By Azimuth and Amplitude Observations, How a Deviation Table is used. Chapter 2 relates to the Composition of Forces, How Compasses act under the Influence of Magnets, How Compasses act when placed in Iron Ships, Sub-Permanent Magnetism, Semicircular Deviation, Effects of Horizontal Soft Iron on Compasses, Quadrantal Deviation. Chapter 3 is on the Co-Efficients A B C D E, and shows that Semicircular Deviation produces Co-Efficients B and C, Quadrantal Deviation produces D and E, A is constant, How the Co-Efficients are Found, Efficients. Chapter 4 is on Heeling Errors, How the Amount of Heel is Ascertained, How Heeling Error is Caused, Position of Ship for Greatest and Least Change, The Heeling Co-Efficient, To find the Change in Deviation from Heeling, Effects of Heeling. Chapter 5 refers to Compensations, Definition, Comparison of Compensated and Uncompensated Compasses, Dumb Card, Compensation of Semicircular Deviation, Compensation of Quadrantal Deviation, Compensation for Heeling Error. Chapter 6 deals with Napier's Graphic Method, How the Diagram is Constructed, Explanation of the Diagram, How the Diagram is used.

(Continued on page 166.)

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SIR ANTONIO BRADY.

SPECIAL NOTICE

The Session will commence with the Opening Meeting, on Thursday, the 21st November, when the usual address will be delivered.

Members whose subscriptions are now due will please to forward the same to the Collector, Mr. G. A. Stretton, 4, St. Martin's Place, Trafalgar Square, London

Monthly Notices.

The Promotion of an Anti-Patent Law Partisan to be Lord Chancellor.—Mr. Stanley and the Turners' Company.—Mr. Stanley and the Royal Geographical Society.—Tribunals of Commerce and Mr. F. Lyne.

PROMINENT amongst the notable transactions of the month is the appointment as Lord Chancellor of Sir Roundell Palmer (now created Lord Selborne). Our readers will remember that he is the arch-enemy of the inventor, and holds to the doctrine that no sort of proprietary interest or legal title to reward ought to appertain to inventors—an opinion that ill accords with any theory of equity worthy of that name, though it may well be considered quite agreeable to the operative principles of that system of Chancery-law which English lawyers have the bare-faced mendacity to term *Equity*. Doubtless, as the presiding genius of that great machine for the production of quibble and chicane, his lordship will be the right man in the right place; whether he will be found equally well fitted to fulfil the office of Minister of *Justice* and Chief Promoter of Legal Reforms, which in the present day are considered as appendant to the Chancellorship, seems by no means so clear, bearing in mind the evident obliquity of his perceptions of right and wrong as to this simple question of remunerating men of genius for labours which are often of so great advantage to our prosperity that they enable us to take the foremost place in the civilised world, instead of sinking down into insular nonentity; enriching us so much that we can even afford to indulge in the expensive amusement of keeping Lord Chancellors, and paying fees to those big legal bellows-blowers, the great Q.C's. We await with considerable interest indications of the course his lordship means to adopt in regard to the reform of our system of judicature, especially as it regards our Patent Laws; and we feel it our duty to warn inventors of the peril they are placed in by the elevation of such a determined and astute opponent of their just rights to be Lord High Chancellor.

Another and more pleasant fact which is worthy of being noted amongst the transactions of the past month is the banquet given to Mr. Stanley, the African traveller, by the Turners' Company—a corporation which has now attained the position of *élite* of the City Guilds, from its list of members comprising as it does men of the highest scientific and industrial eminence, such as Sir Joseph Whitworth, Mr. Crawshay, Professor Tennant, Mr. Forshaw, and many others, who moreover take a lively interest in the Turners' craft. At this banquet the honorary freedom of the company was, with a most admirable address composed and delivered by Mr. John Jones, of the Strand, who is a past master and prominent member of the Turners' Guild, presented to Mr. Stanley.

Mr. Stanley was likewise fêted by the Royal Geographical Society at a banquet given to him by that body at Willis's Rooms on the 21st October, whereat Sir Henry Rawlinson presided.

Last month we alluded to the movement under the guidance of Mr. J. R. Taylor in regard to Tribunals of Commerce. We have received from Mr. Francis Lyne, who has devoted many years to the advocacy of this important matter, a letter enclosing "copy of fifty-eight stimulating letters" to various Chambers of Commerce. It contains the following statements well worthy of the consideration of our readers:—"The City of London, in 1858, petitioned Parliament to grant inquiry. When the prayer was granted, I procured evidence from France, Germany, and Brussels. The Select Committee reported to the House of Commons that the witnesses I had procured were 'competent,' and that they had spoken from 'a long experience.' Then, as to 'Commercial Law,' and the arrangement of 'Bankruptcy matters,' Mr. Thomson Hankey, late Governor of the Bank of England, put questions to those *experienced* witnesses, and obtained such replies as conclusively prove that I had placed *a perfect model* before the House of Commons as a remedy for our distressing evils. In the year 1870 the United Chambers of Commerce introduced into Parliament a Bill for a Tribunal of Commerce, which was *not* founded on the evidence I had given in 1858. Happily for the common-sense of this country, as regarded by commercial Europe, that Bill was withdrawn. In 1871 the United Chambers of Commerce obtained a Select Committee of the House of Commons (as it was alleged) to follow up what I had done in 1858. Whoever organised the evidence for that Committee (according to my feeling) was an enemy to the cause. In 1872 the United Chambers of Commerce prepared another Bill, 'in accordance with the Report of the Committee'—happily that Bill was not presented. On the 24th ult., at their autumnal meeting, Mr. Norwood, M.P., said that Bill 'unquestionably did *require* a good deal of amendment.' I know, on the best authority, that you are intent on asking for what you think 'the lawyers will allow you to have,' and not for what you might through the national morality obtain, if you *rested on* the evidence I gave to the House of Commons in 1858. These, and facts still more grave, have aroused me; and I appeal to *your personal honour* to say if, as the originator of the cause, I have not been abundantly provoked to act as now I am acting. I leave myself at your disposal for any further information."

REVIEWS.

(*Continued from page* 164.)

A Notice of Alteration in Examination Papers for Masters and Mates is given, and as to Examinations in Compass Deviation.

The following statements of methods of making magnets may interest some of our readers.—

Method of Separate or Divided Touch.—Dr. Gowan Knight first introduced this method, but it was afterwards improved by Du Hamel. The bar or needle to be magnetised is placed so that its ends shall rest on opposite poles of powerful magnets. Two others are then taken and inclined about 25° to the horizon, with their opposite poles in the middle, *but not touching each other*. They are then drawn simultaneously to the opposite ends of the bar, and brought back again in an arch to the middle as at starting. Care must be taken that the poles of the magnets so drawn shall be brought towards like poles of the magnets under the bars. After a few repetitions of the process the bar is fully magnetised. The Astronomer Royal, in his treatise on magnetism, calls this process that of double touch. This is the best method for magnetising compass needles, because consequent points are less liable to be formed than by the next method.

Method of Double Touch.—This method was invented by Michell, of Cambridge. It is similar in arrangement to the last, but the movable magnets must make a less angle (about 15°) with the horizon, and they are separated by a bit of cork or wood. In this method the magnets are moved together towards the same end of the bar, and then to the other end, repeating the operation several times on both sides of the bar, but always finishing in the middle. A horse-shoe magnet, with poles close to each other, but not touching, is very convenient for this method, which is generally used for thick bars. Horse-shoe magnets are usually made by stroking them in one direction from the ends to the bend, or the opposite, with another horse-shoe magnet whose poles are at the same distance apart. The ends of the one to be made are connected together by a small piece of soft iron called an armature. This is Hoffer's method.

By the Action of the Earth.—As before stated, the earth acts precisely like a large magnet, and bars of iron and steel, when held in the magnetic meridian with the dip of the place, are converted into magnets by its inductive action. In the former the effects are instantaneously seen; whilst in the latter, from its great coercive force, more time is required. By striking the bars several smart blows, or by suddenly twisting them when held in position, the magnetism may be rendered permanent. It is not absolutely necessary that the bars should be placed as directed, for in any direction not at right angles to the free dipping needle magnetism will be imparted, though much slower, by induction from the earth. This is the reason why workmen's tools are so often found magnetic.

That portion of the work which refers to how a magnet influences compasses, how a compass acts in iron ships, and the effects of horizontal soft iron on compasses are worthy of remembrance by all who have anything to do with compasses on iron ships. The author states the matter thus:—

Bearing in mind the fundamental law of magnetism, that like poles of a magnet repel and unlike ones attract each other, there will be no difficulty in understanding the following remarks. Take a compass, and level with it in the magnetic meridian place a bar magnet at such a distance that its disturbing force shall be somewhat less than the directive force of the needle. Suppose, for example, the blue pole of the magnet be placed nearest the red pole of the compass, then the directive force of the needle will be augmented, as may be proved by causing the needle to oscillate, but it will still point in the direction of magnetic north; now carry the magnet slowly to the right around the compass, always at the same distance from its centre, and with the same pole of the magnet always pointing towards it, and watch the results. The red pole of the needle will follow the magnet farther and farther, until the magnet lies at right angles to the disturbed needle, which will be somewhere to the south of magnetic east. Continue carrying the magnet as before, and we find the needle gradually regains its normal position, which it finally does when the magnet is again in the magnetic meridian; but now the blue magnetism of the bar and needle are contiguous, and hence the directive power of the latter is less than when uninfluenced by the magnet. Let the revolution of the magnet be continued, and soon the red pole of the needle will be found inclining to the westward, owing to the blue pole of the magnet repelling the blue pole of the needle. This will continue until the magnet is again at right angles to the disturbed needle, which will be somewhere to the south of magnetic west; and as the magnet is made to revolve, the deviation of the needle decreases, until the magnet is again in the magnetic meridian. A vertical bar of soft iron, which is a temporary magnet by induction from the earth, will produce precisely similar effects; but in the latter case the induced magnetism changes with a change of geographical position, the results from a bar will therefore vary with a change of latitude and longitude, and will even be reversed on opposite sides of the magnetic equator; but because the power of the magnet is considered permanent, similar effects, though not always equal in magnitude, are produced by it at every place, irrespective of latitude and longitude.

How Compasses act in Iron Ships.—To understand this, it is necessary the student should thoroughly comprehend the effects produced on soft iron by the inductive action of the earth. What has been said about bars is equally applicable to ships. Let *n s* (Fig. 11, p. 51) be an iron vessel built with her head magnetic north, and S N the line of force or direction of the dipping needle; then all the part of the vessel below the magnetic equator E Q will have acquired red or north magnetism (seen by the marking), whilst the part above E Q will have acquired blue magnetism by induction from the earth. The student should draw and trace for himself the changes which take place by altering the direction in which the ship was built. In these, as in the case of iron bars, percussion and vibration by hammering in rivetting render the iron more susceptible to the inductive force of the earth; and a part of the magnetism thus impressed does not again leave the vessel, although, after launching, the major part gradually does. The part retained has received from the Astronomer Royal the name of *subpermanent magnetism*, because it is lasting in its character, and to distinguish it from the permanent magnetism in steel magnets. Its effects on compasses will evidently depend on the direction the ship's head was in whilst being built. If built with her head north, the fore part of the ship has acquired red magnetism, and will act like the red pole of a magnet. The line of its action will coincide with that one which was in the magnetic meridian before the ship was launched; hence in our supposed case, in sailing northerly, the red end of the compass needle will be repelled, and the directive power of the needle diminished. On southerly courses the red end of the needle points towards the stern, which has acquired subpermanent blue magnetism, then the directive power of the needle is increased. When sailing easterly or westerly, the effects on the compass are greatest, because the force acts at right angles to the needle; and at all intermediate stations the disturbances due to the position are intermediate. As the ship's head is brought east of north, repulsion of the red end of the needle takes place, and we get westerly deviation, and it reaches its maximum when the ship's fore-and-aft line is at right angles to the needle; beyond that position the fore part of the ship attracts the blue end of the needle, and westerly deviation is still the result. This continues until the ship's head is south, when the line of the ship's action is in the same line as that of the needle, and no disturbance occurs, but the directive power of the needle is greater. When the ship's head is brought round west of south, the blue pole of the needle is still attracted; this causes easterly deviation, and the maximum is again reached when the ship's fore-and-aft line is at right angles to the disturbed needle; this must occur to the north of west. After that point has been reached, we find the fore part of the ship repelling the red end of the needle, and easterly deviation being still the result until the ship's head is again north. Thus we find that in iron ships the disturbance of the compass is nothing when the ship's head is on the same or opposite point to that in which she was built; and that when her head is in one semicircle, easterly deviation is the result, and when in the other, westerly deviation is produced. The deviation resulting from subpermanent magnetism, and from the effects of vertical iron in the ship, has received the name of *semicircular deviation*, from producing opposite effects when the ship's head is in opposite semicircles of the compass; or easterly deviation is caused when the ship's head is in one-half of the compass, and westerly deviation when the ship's head is in the other half.

Now, because the amount of magnetism induced by the earth in vertical iron changes with a change of geographical position, and is of contrary names on opposite sides of the magnetic equator, hence that part of semicircular deviation which is the result of vertical iron changes as the ship arrives at different latitudes and longitudes, and when she crosses the magnetic equator it becomes of an opposite kind; that is, if westerly deviation be produced on one side, easterly will be produced on the other. The part due to subpermanent magnetism remains constant in kind though different in amount in all latitudes and longitudes, unless the ship be subject to strain or other mechanical violence.

On the Effect of Horizontal Soft Iron on Compasses.—As shown in art. 50, the effects of a horizontal bar of soft iron carried around the compass in a similar way to the magnet vary as the cosine of the magnetic azimuth, that in the direction of the magnetic meridian they are wholly directive, and therefore produce no disturbance; that at east they vanish because cos 90° = 0, and between these two extremes a maximum is attained. Similarly a disturbance occurs in the SE., SW., and NW. quadrants. Because blue magnetism is induced in the end of the bar nearest the needle, in the NE. and NW. quadrants, attraction of the red end of the needle takes place at those times; and when the ship's head is in either of these quadrants the horizontal iron in her causes a deviation easterly in one quadrant and westerly in the other. Again, in the SE. and SW. quadrants red magnetism is induced in the end nearest the needle, and attraction of the blue pole of the needle is the consequence, thus again causing opposite deviations. Hence, because in the NE. and SW. quadrants the red end of the needle is drawn to the right, easterly deviation is the effect, but in the SE. and NW. quadrants opposite consequences follow. From these results, viz., that in every alternate quadrant different effects are seen from the action of horizontal soft iron, the deviation arising therefrom has been called *quadrantal deviation*.

THE WOOLWICH INFANT.

Faultless in its construction, and most carefully tended in its birth, the "Woolwich Infant," as it is ironically called, was most judiciously nursed in its babyhood. Never suffered to be charged with "brutal" R. L. G. powder, it was allowed to use nothing but mild pebble powder, and the shortest 700 lbs. projectiles. Sufficient intervals were allowed

between its successive discharges for the chamber to cool, so that the powder should not be consumed too rapidly nor too completely, lest that violence of recoil which, as every sportsman knows, accompanies a heated barrel, should risk its valuable life. The gun was, moreover, fired in a nearly horizontal position, so that high elevations should not impede the exit of the shot, and overstrain the breech. Even an increasing spiral, that "fond thing vainly invented" to relieve the chambers of guns, was resorted to, though the Special Committee on Explosives could only "*think* that an increasing twist in the rifling *should* give relief to the gun, but their experiments have not yet (November 19th, 1869) been extended in this direction"; and the learned Professor of Artillery had written—"Whether the decrease of strain (at the bottom of the bore), due to the less resistance of the shot to motion, with an increasing twist is sensible, *or of practical importance, has not been decided by experiment.*" Nevertheless, after the most careful nursing, and spreading 68 horizontal discharges of mild pellet powder, and the shortest 700 lbs. projectiles, over many months, an "incipient crack" about twelve inches long occurred in the lower groove, the centre of the split being about 20 inches from the chamber, or about 14 inches *outside* the ordinary area of maximum powder pressure. Four months' rest was given to the "Infant," and then, in February, 1872, five more rounds were carefully fired, when cracks were found in the "right top" and "right bottom" grooves looking from breech to muzzle. Several slight fissures were also found in the lands and in the centres of one or two other grooves; whilst the chamber bore impress of having received so violent a strain from the expansion of the gases as almost to have crushed the metal.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS.

Subjects for Papers. (Session 1872-73.)—The Council of the Institution of Civil Engineers invite communications dealing in a complete and comprehensive manner with any of the subjects comprised in the following list, as well as upon others, such as—*a.* Account of the Progress of any Work in Civil Engineering, as far as absolutely executed (Smeaton's Narrative of the Building of the Eddystone Lighthouse may be taken as an example). *b.* Descriptions of distinct classes of Engines and Machines of various kinds; *c.* Practical Essays on Subjects allied to Engineering, as, for instance, Metallurgy; and *d.* Particulars of Experiments and Observations connected with Engineering Science and Practice.

List.—1. On the Application of Graphic Methods in the Solution of Engineering Problems, and in the Reduction of Experimental Observations. 2. On the Elasticity, or Resistance to Deflection, of Masonry, Brickwork, and Concrete, with observations on the Deflection of the tops of Bridge Piers by unequal loading of the Arches abutting on them. 3. On the Methods of Constructing the Foundations of some of the principal Bridges in Holland and in the United States. 4. On Bridges of large span, considered with reference to examples now in progress or recently completed in the United States; including an account of the testing, and of the effects produced by variations of temperature. 5. On the Theory and Practical Design of Retaining Walls for sustaining earth or water, and on experimental tests of the accuracy of the various theories. 6. On the Different Systems of Road Traction Engines, with details of the results in each case. 7. On the Use of Concrete or Béton in large masses for Harbour Works and for Monolithic Structures. 8. On Dredging Machinery, and on the cost of raising and depositing the material. 9. On the Appliances and Methods for Rock-boring and Blasting in this country and abroad, and on the results obtained. 10. On the Gauge of Railways. 11. On the Systems of Fixed Signals on Railways, and on the connection between the signals and the points. 12. On Modern Locomotive Engines, designed with a view to economy, durability, and facility of repair, including particulars of the duty performed, of the cost of repairs, &c. 13. On the different Systems for Surmounting Inclines on Mountain Railways. 14. On the various Modes of Dealing with Sewage, either for its disposal or utilisation. 15. On the Separate System of Sewering Towns, with a detailed description of the works in a town to which this system has been wholly or partially applied, and particulars as to the results. 16. On the Ventilation of Sewers, with a resumé of the Experiments as to the motion, pressure, &c., of Gas in the Sewers. 17. On the Constant Service of Water Supply, with special reference to its introduction into the metropolis, in substitution for the Intermittent System. 18. On Street Railways and Tramways through Cities and Towns, and on the best mode of working them. 19. On the application of Steam as a Motive Power for Pumping Water or Sewage, with a comparison of the advantages of different classes of Engines, and details of the cost of working for long periods. 20. On the various descriptions of Pumps employed for Raising Water or Sewage, and their relative efficiency; and on the employment of Water as a Motive Power for pumping by means of Water-Wheels, Turbines, Water Pressure Engines, or other Machines. 21. On the Employment of Steam Power in Agriculture. 22. On the Laws governing the Flow of Steam and other Gases through Orifices, Pipes, &c., and on Experiments to determine these Laws. 23. On the Methods of Transmitting Force to distant points. 24. On the best practical Use of Steam in Steam Engines, and on the effects of the various modes of producing Condensation. 25. On the modern practice of Marine Engineering, having reference to Economy of Working Expenses, by Superheating, Surface Condensing, Great Expansion, High Pressure, &c. 26. On the Present State of Science in regard to the Manufacture of Gas for the purposes of Illumination. 27. On the Construction of Sluices for the expeditious filling and emptying of Locks of large size on navigable Canals. 28. On the Harbour and Dock Works at Spezzia. 29. On the Maintenance, by Sluicing, of the Harbours on the Coasts of France, Belgium, and Holland. 30. On the Practice and Results of Irrigation in Northern India. 31. On the Sea Works at the mouth of the Adour, and the effect produced by them on the bar of that river. 32. On the Sea Works at the mouth of the River Maas, and the effects produced thereby. 33. On the Manufacture of Iron and Steel as now pursued, the effect on strength and tenacity of the admixture of substances with the Ore, and any test other than fracture by which the quality may be ascertained. 34. On the various Methods of Draining distant isolated sections of Mines. 35. On Compressed Air as a Motive Power for Machinery in Mines, with some account of its application on the Continent. 36. On the Use of the Diving Apparatus in Mines, especially in Westphalia and in Germany. 37. On the Systems and Apparatus at present used in Telegraphy.

For approved original communications the Council will be prepared to award the premiums arising out of special funds devoted for the purpose. They will not, however, consider themselves bound to make any award should there not be any communication of adequate merit; but, on the other hand, more than one premium will be given if there are several deserving memoirs on the same subject. It is to be understood that in this matter no distinction will be made between essays received from a Member or an Associate of the Institution, or from any other person, whether a native or a foreigner.

The communications should be written in the impersonal pronoun, and be legibly transcribed on foolscap paper, on the one side only, leaving a sufficient margin on the left side in order that the sheets may be bound. A concise abstract must accompany every paper. The drawings should be on mounted paper, and with as many details as may be necessary to illustrate the subject. Enlarged diagrams, to such a scale that they may be clearly visible when suspended in the Theatre of the Institution, should be sent for the illustration of particular portions. Papers which have been read at the meetings of other societies, or have been published in any form, cannot be read at a meeting of the Institution, nor be admitted to competition for the premiums. The communications must be forwarded, on or before the 31st of December, 1872, to the house of the Institution, No. 25, Great George Street, Westminster, S.W., where any further information may be obtained.—Charles Manby, Honorary Secretary; James Forrest, Secretary.

Excerpt Bye-Laws, Section XV., Clause 3.—"Every paper, map, plan, drawing, or model presented to the Institution shall be considered the property thereof unless there shall have been some previous arrangement to the contrary, and the Council may publish the same in any way and at any time they may think proper. But should the Council refuse or delay the publication of such paper beyond a reasonable time, the author thereof shall have a right to copy the same, and to publish it as he may think fit, having previously given notice in writing to the Secretary of his intention. No person shall publish, or give his consent for the publication of any communication presented and belonging to the Institution, without the previous consent of the Council."

Premiums Awarded. (Session 1871-72.)—The Council of the Institution of Civil Engineers have awarded the following premiums:—1. A Telford Medal and a Telford Premium in Books to Bradford Leslie, M. Inst. C.E., for his "Account of the Bridge over the Gorai River, on the Goalundo Extension of the Eastern Bengal Railway." 2. A Telford Medal and a Telford Premium in Books to Carl Siemens, M. Inst. C.E., for his paper on "Pneumatic Despatch Tubes: the Circuit System." 3. A Telford Medal and a Telford Premium in Books to William Bell, M. Inst. C.E., for his paper "On the Stresses of Rigid Arches, Continuous Beams, and Curved Structures." 4. A Telford Medal and a Telford Premium in Books to John Herbert Latham, M.A., M. Inst. C.E., for his description of "The Soonkésala Canal of the Madras Irrigation and Canal Company." 5. A Telford Medal and a Telford Premium in Books to George Gordon, M. Inst. C.E., for his paper on "The Value of Water, and its Storage and Distribution in Southern India." 6. A Telford Premium in Books to Frederick Augustus Abel, F.R.S., for his paper on "Explosive Agents applied to Industrial Purposes." 7. A Telford Premium in Books to Bashley Britten for his paper on "The Construction of Heavy Artillery, with reference to Economy of the Mechanical Forces engaged." 8. The Manby Premium in Books to Charles Andrews, M. Inst. C.E., for his paper on "The Somerset Dock at Malta." The Council have likewise awarded the following prizes to Students of the Institution:—1. A Miller Prize to Oswald Brown, Stud. Inst. C.E., for his paper on "Sewage Utilisation." 2. A Miller Prize to Arthur Turnour Atchison, B.A., Stud. Inst. C.E., for his paper on "Railway Bridges of Great Span." 3. A Miller Prize to John Addy, Stud. Inst. C.E., for his paper on "The most suitable Materials for, and the best mode of Formation of, the Surfaces of the Streets of large Towns." 4. A Miller Prize to Alfred Edward Preston, Stud. Inst. C.E., for his paper on "Wood-Working Machinery." 5. A Miller Prize to William Patterson Orchard, B.E., Stud. Inst. C.E., for his paper on "The Education of a Civil Engineer."

Notice.—It has frequently occurred that, in papers which have been considered deserving of being read and published, and have even had premiums awarded to them, the authors may have advanced somewhat doubtful theories, or may have arrived at conclusions at variance with received opinions. The Council

would, therefore, emphatically repeat that the Institution must not, as a body, be considered responsible for the facts and opinions advanced in the papers or in the consequent discussions; and it must be understood that such papers may have medals and premiums awarded to them on account of the science, talent, or industry displayed in the consideration of the subject, and for the good which may be expected to result from the discussion and the inquiry; but that such notice or award must not be considered as any expression of opinion on the part of the Institution of the correctness of any of the views entertained by the authors of the papers.

Mr. Thomas Howard, of the King and Queen Ironworks, Rotherhithe, who was for 37 years an Associate of this Society, has bequeathed to it the sum of £500, free of legacy duty, which sum he has by will directed "to be invested, and the interest thereof to be applied in such manner and under such conditions and instructions as the Council of the said Institution may think most expedient for the purpose of presenting periodically a prize or medal to the author of a treatise on any of the uses or properties of iron, or to the inventor of some new and valuable process relating thereto, such author or inventor being a Member, Graduate, or Associate of the said Institution."

SOCIETY OF ENGINEERS.

The first meeting of the Society for the session 1872-3 was held on Monday 7th inst., the chair being occupied by the president, Mr. Jabez Church. A paper was read by Mr. E. G. Bartholomew on telegraphic batteries. The author commenced by referring to the two papers he had previously read before the Society on the subjects of telegraphic conductors and telegraphic instruments, observing that the present paper on batteries would render the subject complete. He compared the electric telegraph to the steam-engine; the conductor represented the steam-pipe, the instrument the engine, and the battery the boiler. The author then went on to describe the different kinds of batteries, the principles of their construction, and to explain the laws by which the force generated was governed. Pointing out that the force generated was proportionate to the chemical action and to the consumption of some of the elements of the battery, he showed the necessity for preventing any such action or decomposition from proceeding unless the resulting force was utilised. The author further showed how, by rendering the surface of the most oxidisable metal homogeneous, local action was suppressed. The various methods of joining up the elements, whether as forming one large plate or in series, were alluded to, and the resulting character of the force explained.

ANTI-FERMENTATIVE AND ANTI-PUTREFACTIVE PROPERTIES OF SILICATE OF SODA.

Messrs. Rabuteau and Fernand Papillon recently brought before the Academy of Sciences the influence of the above-named salt upon alcoholic fermentation, the fermentation of urea and of milk, and stated that it gave birth to essence of bitter almonds (*amandes amères*). Like borax, of which M. Dumas has recently investigated the action, the silicate of soda hinders the action of putrefaction and manifestation of its divers agents. The silicate of soda is, however, considered to be more energetic than borax. To arrest fermentation a less dose is necessary than for anti-putrefaction. Upon the superior animals the silicate of soda has been found to exercise a poisonous effect of a very decided character: whilst two grammes of borax will not kill a dog, one gramme of silicate of soda will determine the death of the animal. In fine, the silicate of soda is capable of checking all infectious developments which play so great a part in pathology.

Occupations for Leisure Hours.

Notes on Amusements, Art, and General Literature.

Fully recognising the fact that scientific and technical progress form the proper work of the Scientific Review, we nevertheless deem it desirable to bestow some attention on the various means which are being presented to public notice of passing a leisure hour in an agreeable manner, for we know that the avocations in which most of our readers are engaged are so exhaustive that they even more than other men are in need of holidays and pastimes, if they would preserve the *mens sana in corpore sano*; and to this end we would advise them not to restrict themselves to amusements which are of a scientific tendency, but to range freely over the whole of the pastures of pastime. With these views and intentions we now present our readers with the following notes.

Polytechnic.—At this old-established place of entertainment and instruction, the practical and the playful, holiday pleasures and scientific instruction, are so blended together that one scarcely knows whether it ought to be treated as a place of amusement, or simply as a means of scientific education in an agreeable manner on the *dulce et utile* principle; for on the one hand we have the lectures of Professor Gardiner on "Saving Coal," which are of high scientific and useful character; and on the other hand we have presented to us as an interesting and pleasant entertainment a new and beautiful ghost illusion, named *The White Lady of Avenel*, which all readers of Sir Walter Scott's works will immediately recognise as founded upon his tale of "The Monastery," the incidents made use of in this entertainment being the appeal to the White Spirit by Halbert Glendinning, in order that he may obtain the sacred book belonging to Mary Avenel, which had been stolen from her. Having requested the Spirit to give him the book, she consents, and the volume is seen surrounded by flames upon an altar which rises by her side. The White Lady takes the book and gives it to Glendinning, who beseeches her to teach him to understand it. As the figure wanes away Glendinning, awe-struck, falls senseless. In putting this illusion on the stage no pains have been spared to realise the scene as described in Scott's novel. The White Lady although perfectly distinct is thoroughly ethereal, and the rocks and waterfall can plainly be seen through her, and as she ceases to speak her form fades, becoming clear and bright when her voice is again heard. The peculiar and beautiful effects are produced by a new arrangement and combination of lights. On the whole we can heartily commend the Polytechnic ghost entertainment to the attention of all pleasure-seekers.

Royal Court Theatre.—This theatre, although situate in the western suburb of Chelsea, by the Metropolitan District Railway is to dwellers in the east and south centres of the Metropolis rendered as accessible from the City Mansion House station, Charing Cross, or Westminster Bridge as many of the theatres which are considered as those of London proper, since that railway lands one close to its doors. It is very prettily decorated, and the official attendants wear a sort of Court livery. At the present time it is under the management of Miss M. Litton, who produces for the entertainment of the public a programme as *recherché* as could reasonably be required. Recently the list of pieces represented comprised a spirited farce by Maddison, *My Wife's Second Floor*, and the *Son of the Soil*, by H. C. Merivale, a romantic drama referring to incidents in the old French Revolution, taken from Ponsard's celebrated play of *Le Lion Amoureux*, the principal characters in which were most ably sustained by Mr. Hermann Vezin, Mr. W. H. Fisher, Mr. W. J. Hill, Miss Ada Dyas, Miss Emma Barnett, and Miss E. Kita. From which it will be seen that this place of entertainment is worthy of being visited by all intelligent pleasure-seekers.

General Literature.—We have much pleasure in noticing the publication in pamphlet form of a poetical work by William Alfred Gibbs, Esq., who is so well known as the inventor of improvements in drying hay, corn, and other substances. It is entitled *An Address to Working Men* (reprinted by desire), from the *Story of a Life*, and other poetical works by the same author. The publisher is A. W. Bennett, 5, Bishopsgate Street Without. It is published at a cheap rate, and as its poetry is of a pleasant readable kind, and its object the advancement of religion and morality amongst working men, we hope it may find its way to every working man who has any poetry left in him, and do all the good that its author so evidently desires to accomplish.

PROGRESS OF FOREIGN SCIENCE.

We read in *Les Mondes* that a convention has been entered into with M. Louis Favre for constructing a railway tunnel through Mont Saint Gothard, and that in carrying out this great work he will have the co-operation of Professor Daniel Colladon, who rendered such good service in regard to tunnelling Mont Cenis. The same journal has a communication, signed Louis Hervé, stating that the potato disease has committed ravages in France such as have not been experienced for more than fifteen years. Amongst other communications of interest to be found in the journal above referred to is a full description of improvements in electric clocks by M. C. F. Milde, accompanied by engravings. Those of our readers who wish to know more about this subject can peruse this work at the Patent Office Library, London.

In the *Chronique de la Science* we find that the construction of a meteorological observatory on the summit of the Puy de Dome is in progress. A very full and illustrated description of improvements in the submarine electric cable by Ferdinando Tommasi is given in a recent number of our French contemporary, which also contains a proposition for what is termed a universal caravan—that is, it is proposed that a number of scientific, literary, and artistic people should travel in company, provided with the necessary scientific instruments, and should visit various parts of the globe with the view to prosecute valuable researches.

THE WHITWORTH GUN TRIALS.

The special correspondent of the *Daily Telegraph* describes these trials, which took place at Southport, as follows:—

The experiments with the Whitworth patent 9-pounder breech-loading rifle field-gun commenced at mid-day by firing 10 rounds of shrapnel shells at targets 9 feet high by 21 wide at 2000 yards. The shells were fitted with special Petman's concussion fuses, made to burst on grazing in front of the targets. Previous experiments under more favourable conditions have given an average of 23 perforations per round well scattered over a target 14 ft. by 9; but to-day, from the strong, gusty nature of the wind, the practice was not good, and the ground proving too soft and sludgy to ignite the fuses, the trials were very unsatisfactory. For rapidity of firing the result was very different; the first five rounds were got off by an unpractised detachment of mechanics from Sir Joseph Whitworth's factory in 47 secs. Indeed, judging from what took place, the limit of rapidity seems to be the capacity of a man to hook on friction tubes to a line, place them in the vent, and fire. Fifteen rounds were next got off in 3 min. 36 secs., of which 34 secs. represented a loss of time occasioned by failure of the friction-tubes, and finally ten were fired without any delay from this cause in 1 min. 43 secs. For this rapid firing the wheels of the carriage were locked by a

special arrangement in the nave, which had the effect of reducing the recoil to about 18 inches. Without this locking apparatus the recoil of the gun on the same ground would have been between five and six feet. During the whole of this rapid firing the breech worked with perfect ease, and the result was considered by the military spectators as very satisfactory. Ten rounds of case shot were next fired at targets 28 ft. by 9 ft. high, at a range of 200 yards. At this short range the effect seemed to be very like a charge of shot from a fowling-piece. The shot weighs 8¾ lbs., contains 83 bullets of 17 to the pound, and is propelled by 1¼ lbs. of powder. The result was 226 bullets and fragments of the case struck the target. The concluding experiment was for the purpose of showing the capabilities of the gun for firing long projectiles, with low charges of powder, at very high elevations. A common blind shell, five diameters in length, which would contain a bursting charge of 13 ozs., was fired at an elevation of 42 degrees with a small charge, and it ranged like a mortar through the air plainly visible from its low velocity to a distance of 500 yards. To show that the same description of shell was suitable for ordinary firing one was filled with the bursting charge of 13 ozs., and fired at three degrees of elevation. A range of 2000 yards was obtained, and this time the Petman fuse did its work, for the shell burst properly and immediately on its first graze. The English, French, Brazilian, and American naval officers who were present on the first day again watched the experiments, which were conducted under the able superintendence of Mr. Leece. The results to all practical artillerists speak for themselves, and, as we have a right to have the best weapons which can be produced, the sooner there is a fair competitive trial between improved Whitworth guns of all sizes and corresponding weapons on the Woolwich system, the sooner it will be demonstrated that, as regards rifling, we are on a wrong tack, and, for the sake of our national reputation and of economy, the sooner we alter our course the better.

GUNPOWDER EXPERIMENTS.

On 9th October that part of Plumstead Marshes which adjoins Woolwich Arsenal was the scene of highly interesting and important experiments, conducted under Government authority, for the purpose of testing the powers of the magazines or receptacles for small quantities of gunpowder, designed by Messrs. Milner, of Liverpool, in resisting fire and preserving the contents for several hours. The experiments were under the supervision of Major Majendie, her Majesty's Inspector of Gunpowder Works, and were witnessed also by a considerable body of scientific gentlemen and a number of the superintendents of fire brigades from various large towns in Great Britain and Ireland. It was stated on the official programme that the opinion of the superintendents of the principal fire brigades in the United Kingdom had been taken as to the time for which a magazine, to be really safe, ought to be able to resist such a fire as it might be exposed to in the shop or warehouse of a retail dealer or in an ordinary dwelling-house. The highest time assigned by any of these officers in their replies was six hours, Captain Shaw being of opinion that in a much less period any safe in a burning building would be covered with débris. Accordingly it was assumed that if a magazine were able to resist fire for six hours it would afford all the protection which is actually necessary, and these magazines were constructed on that basis. The powder placed in them was packed in the two ways in which it is generally stored by retail dealers and sportsmen, viz., some loose and some in tin canisters, the greater quantity of powder being deposited in each magazine than was considered necessary to test satisfactorily the degree of protection afforded. Externally the magazines present the appearance of Milner's ordinary fire-proof safe, but each chamber between the outer and inner skins is furnished with alum, a peculiarly dry sawdust, and certain chemicals which, when acted on by heat, throw off sufficient moisture to deaden the effect of the most intense external fire. Four of these magazines were brought up for testing, each to be tried in a separate furnace loosely constructed with fire-brick and furnished with coal and wood. In the first, charged with four tons of coal, was placed a magazine large enough to hold 100 lbs. of gunpowder loose or in canisters; but for the present experiment a few ounces only were placed in the recess. A second magazine contained a charge of ten pounds of powder in canisters, and was placed in a furnace filled with five tons of coal. In the next—a magazine of the same size and construction as the first—was placed no less than 25 lbs. of loose powder in a quarter barrel open at the top. No. 4 contained five canisters of 1 lb. each, distributed in various positions round a keg containing 5 lbs. of loose powder. In each magazine were two of Negretti and Zambra's registering thermometers, and in each were small bars of metal alloys that would melt at well-ascertained degrees of heat ranging from 340 to 558 degs. Fahrenheit. Nearly seven tons of coal were piled on and around the No. 4 safe. At 10 a.m. the first fire was lighted, petroleum having been cast on the damp coals and wood to raise a blaze in the drenching rain which, during the whole morning, rendered the marshes more intensely marshy than usual. For six hours and twenty minutes was each of the magazines containing supplies of gunpowder subject to the intense heat of the furnaces, the fires being fanned by a slight breeze which swept the common, and the flames fed rather than damped by the rain. Care had been taken to post sentries in order to prevent anyone passing within the range of a possible explosion, and much interest was felt in watching the progress of the furnaces—interest that was heightened by the thought that any one of them might be blown to the winds at any moment. At twenty minutes past four the first and most lightly charged magazine was taken from the fire, where it had been subject to burning heat for six hours and twenty minutes. On the bolts being driven back and the door opened a burst of vapour rushed out, leaving the interior then quite free. The thermometer indicated 210 degs. Fahr., or less than half the heat at which dry gunpowder will explode. Of the contents of the six canisters that were taken out two were slightly damp; the other four were all dry, and all were fired by Major Majendie to show that the explosive quality of the gunpowder had not been affected by any chemical action as some had supposed, or, indeed, favourably hoped that it might be. As regarded the magazine itself the plates were at red heat, the door slightly bulged with the pressure of the steam within, and two small holes had been burnt through the outer thin iron casing near the bottom. The experiment was regarded by all present as being highly satisfactory. Nos. 2, 3, and 4 remained for the night in fires which were burning brightly when the visitors left in the dusk of the evening. Sentries were posted to guard the approaches, and to note the time at which any one or more of the magazines exploded. Ten hours was the utmost limit fixed by the authorities for the trial, and few believed that the safes could possibly withstand fire for that period; but there were not wanting those who expressed their confidence that the stores of gunpowder would be found intact even after the magazine had been literally under fire for twenty-four hours. The final examination was to be made at noonday.

THE POLYTECHNIC COLLEGE.

For the last ten or twelve years evening classes similar to those which Prebendary Mackenzie established originally in the City of London have been carried on most successfully under the rev. gentleman's supervision at the Polytechnic Institution. As in the City the "evening classes" have now taken the more permanent corporate form of the "City of London College," so it has been thought right to effect the same transformation in regard to the classes at the Polytechnic Institution, which will hereafter continue their sphere of usefulness as "The Polytechnic College." The session, which commenced on Monday, was inaugurated by an address from the Rev. Prebendary Mackenzie, the chair being occupied by Lord Shaftesbury. In the course of an interesting address, the rev. gentleman explained the necessity of giving a more permanent constitution to the classes, which might otherwise be broken up by the loss of one or two of the moving spirits who have so long done the good work, and also sundry good and sufficient reasons why the title should be the one chosen for the college, and why they should continue to pay the attention that has hitherto been devoted to instructing ladies in those classes—one reason being their undoubted claim to be qualified for earning their own living; and another, the beneficial effect of their presence in stimulating the industry and energy of the male students. The noble chairman, in addressing the assembly, declared the college to be opened, endorsed the view of the reverend principal that the two main objects of such an institution were to provide the means of good sound education to classes who could not obtain it in other ways, and to counteract the evils prevalent in the present day from vicious literature, which the noble lord thinks is rapidly undermining the principles of the people and the social system of the country. On this text he delivered an earnest and somewhat lengthened address, which was listened to with much attention, and was well received. The proceedings were brought to a close by votes of thanks proposed by Sir Thomas Chambers and Mr. Webster, Q.C., to the noble earl and the Rev. Prebendary Mackenzie.

THE MACHINERY OF SHIPS OF WAR.

The extent and variety of the mechanical arrangements in our ships of war will be familiar to most of our readers. Nothing excites the wonder of the visitor to one of our turret ships, for example, more than the apparently chaotic jumble of engines, wheels, pipes, cranks, &c., by which he is surrounded, and even the experienced engineer in charge, who is supposed as a part of his duty to have mastered the intricacies of this labyrinth of mechanism, becomes occasionally bewildered in attempting to distinguish between pump gear and turret gear, steam gear and hand gear, &c. Not only, however, can a good reason be given for the presence in the ship of every part of this mass of machinery, but the inevitable tendency is to add to its complexity. The increasing weight of the guns mounted on shipboard, and also the increasing danger of a want of celerity in the movements of the ship, render it extremely probable that the use of manual labour will be dispensed with to a far greater extent than at present, and that the power stored up within the iron walls will be made still further available for the rapid manipulation of the ship and her ponderous ordnance.

INVENTION-RIGHTS.

"If—says Mr. Horace Greeley—the indestructible foundation of the right of property is labour, then the right of Elias Howe to that combination which gives practical existence and value to the sewing machine is as perfect as any other right of property.—The craftsman merely fashions, adopts, or recasts materials which may be regarded in some measure the common property of mankind, while the inventor builds into void space, and adds potentially by his own creation to the enduring wealth of nations. I cannot perceive why his right of property is not as perfect and even more pervading than that of the maker of a locomotive or the grower of grain. I have considered what has been urged in favour of a

restriction of this class of property to the material thing wrought, and the argument seems to me absurd. The inventor labours to perfect not a single locomotive, but *all* future locomotives, and to make them less costly or more efficient. When completed the machine may burn to ashes; yet no one would say that his labours have been in vain.—As to the abolition of patent systems, which has been advocated by some eminent men, I shall be more reconciled to it when I am assured that this act will be swiftly followed by a repudiation of *all* rights of property, or more strictly of all legal guarantees and defences of such rights. Whenever the laws of my country refuse to protect the inventor and author, they should in simple consistency bid the landholder, the bondholder, and the merchant, 'take care of yourself, and all you call your own.'—The title to wild lands granted by a European monarch who never saw and knew not how to bound them cannot be better than that of Whitney to the cotton-gin, or that of Daguerre to photography. When these rights are successfully denied, no rights of property will be secure.—I acknowledge all property is held subordinate to the dictates of the national well-being, and I only insist that intellectual property should be recognised by law as standing on a common foundation with other property, and equally accorded the protection of the State and the respect of all who hold property no robbery, but justly entitled to defence and support from the wise and the good."—*Mechanic and Inventor.*

TRIBUNALS OF COMMERCE.

Mr. J. R. Taylor informs us that a requisition is in course of signature to the Lord Mayor, asking that a meeting may be convened at an early day at Guildhall for the purpose of advocating a Tribunal of Commerce for London; and to this requisition are attached the names of aldermen and M.P.'s and other distinguished personages more or less known in the commercial world. It appears the tribunals of commerce in foreign countries are satisfactory in action. In Mayence, in ten years, 8753 cases had been thus disposed of. In Copenhagen so effectually have the courts there embraced courts of reconcilement and arbitration, that out of 10,000 cases only 50 were left to be determined by the ordinary law-courts. In France tribunals of commerce judge in all contests relative to engagements and transactions between merchants, traders, and bankers, in disputes between partners and between all other persons when referring to commercial dealings. They also take cognisance of every case connected with bankruptcies according to the Bankruptcy Code. In Hamburg, the great emporium of commerce of the north, tribunals of commerce take cognisance of all disputes concerning commercial affairs, whether the contending parties are merchants or not, of all disputes about partnerships, and of all matters connected with bankruptcies. Under certain sums there is no appeal against the judgment of the tribunal, and thus the disputes which are constantly arising in a mercantile community are settled speedily with little trouble and at a very small cost. What is wanted is something similar in this country. As it is law is a costly remedy, and ofttimes a great injustice. Our whole process is wrong and wants thorough reformation. As we have already stated, we see no reason why a special branch of the Tribunal should not deal with the Patent question, and we give this movement our hearty support.

FRENCH SCIENTIFIC WORKS RECENTLY PUBLISHED.

The following works issuing from the French press appear to be worthy of commendation:—"Life of Copernicus, and History of the Discovery of his System," by Camille Flammarin. "Studies and Lectures on Astronomy," by the same author. "Experimental Studies on certain Nervous Phenomena, and for the Solution of the Spiritualism Problem," by M. A. Chevillard, Professor of the *Ecole National des Beaux Arts.*

Correspondence.

*** Discussion is invited upon any subject within the scope of the Scientific Review in which its readers may be interested; but correspondents are requested to be brief, as space is limited, and to remember that each individual writer is alone responsible for the opinions he may express.

PATENT LAWS.

To the Editor of the Scientific Review.

Sir,—I venture to suggest a further clause in any future amendment of the Patent Laws, namely —And be it further enacted, that all patentees shall be taken and deemed to be wards of the Commissioners of Patents; and all parties infringing or pirating any patent so granted by said Commissioners shall be proceeded against by the said Commissioners; and all fines or damages so recovered from all parties so infringing or pirating any patent-right shall go to the funds or balances in hand from time to time accruing after expenses paid in connection with Patent Office.—Yours respectfully,

A Reader from No. 1.

Manchester, Sept. 24, 1872.

[We think the above suggestion, though not quite in accord with our legal system, very suggestive of good, assuming our correspondent to intend that the funds so collected shall be distributed to the patentees when a certain amount has been reached.—Ed. S. R.]

TOOTH'S IMPROVEMENTS IN PUDDLING IRON.

To the Editor of the Scientific Review.

Sir,—I have read with some surprise in the June and July numbers of your valuable journal, amongst the reviews, the following article, namely, "A Sketch of various Plans which have been proposed as a Means to effect Puddling Iron by Machinery," which appears to have been taken from a pamphlet, the author of which is a Mr. William Yates, and is published by Vacher and Sons, of Parliament Street, Westminster. As the statements contained therein are so contrary to facts, I feel sure you will kindly grant me space in your paper to contradict assertions that could only have been intended to mislead the public. Absences from England and other causes have prevented me from addressing you on this subject sooner.

It is not my intention, in this my first communication, to enter into discussion upon the statements made by the various persons whose names are mentioned, but simply to give as concise a history as possible of my own connection with this all-important subject of puddling iron by machinery.

I first commenced making experiments in the yard of Mr. William Benton, boiler-maker, Bilston, Staffordshire, as far back as the year 1838, and found the difficulties I had to contend with were so great that I did not then succeed in accomplishing the object I had in view, which was principally owing to the impossibility of getting any linings for the machine that could withstand the great heat, as well as the chemical action of the materials employed in puddling the iron: but in the year 1847, after various trials and repeated failures, I came up to London and took premises at 76, Broad Street, Lambeth, thinking I could obtain valuable information and instruction from the notable Lambeth potters that would enable me to obtain such a lining as would overcome all difficulties, and be suitable for the purpose; and there I erected a machine under the superintendence of Mr. Thomas Dickens, now manager over the Iron Department of the London Gas Works, and I obtained a cylinder for that machine from Mr. Benton, of Bilston, made upon an improved principle, with flanges and plates fixed upon a swivel joint to enable me to withdraw the charge from the furnace, which was one of the previous difficulties, the cylinder being so delicately fixed that it could be made to revolve by hand-power, even by a boy with a winch handle.

The internal lining of the cylinder was parallel to the axis. This apparatus, so far as the machine was concerned, was perfect, and has never been improved upon up to the present time; the only other difficulties then left to be encountered were the lining, the flue, the fire-box, and the withdrawing of the charges.

Finding that I could not succeed with the Lambeth potters, I then went to Bleak Hill, near Poole, Dorsetshire, and there I took a pottery with clay pits, and erected a very large kiln, and made experiments in linings for the machine for upwards of two years, at a cost of over £2000, and at length I was gratified by finding my great efforts rewarded with success, at all events so far as one quality of iron was concerned. Having accomplished this desirable object I returned to London, and recommenced business as an engineer at the Castle Iron Works, Castle Street, Southwark, and made my first application for a patent under the old law, which, however, for various reasons I did not think proper to proceed with. This was in the year 1851.

I must now call your readers' attention to the patent that was taken out in 1853 by the Messrs. Walker and Warren, "For Improvements in the Manufacture of Iron," as described in your review, and which I most emphatically say was a true copy of everything I had previously done with two exceptions. The first was that instead of having the lining placed parallel to the line of rotation of the axis they made a double inclined hearth inside the cylinder, which has been sufficiently explained in your able review. The next exception was that they had placed their cylinder upon rollers, in such a position as required power sufficient to lift at least two-thirds of the weight of the cylinder itself and the charge within, which was anything but an improvement upon what I had already done, inasmuch as my cylinder revolved upon rollers which supported the centre of gravity, consequently the cylinder could be moved as easily as the pendulum of a clock.—I remain, &c. W. H. Tooth.

The Patent Metallic Cartridge Works, Albany Terrace, Old Ford Road, Bethnal Green, 1st October, 1872.

SUGGESTION AS TO THE AGE OF THE EARTH.

To the Editor of the Scientific Review.

Sir,—Geologists aver that this our world must have been ages in formation, ages in existence; but with no historic records, no traditions even to confirm that averment—*only* the positive record of the stones to the fact—is it not possible that it is our Planet that has been ages in formation and existence, and that this our present world is of far more recent construction, re-created out of the material of a previous world? Geologists speak of "an enormous gap in the geological record between the period of cave men and historic man, represented by the whole alluvial history and system of our existing rivers." Might not that "gap" be the period of the reproduction of an overturned and renewed earth?

H. B.

The Inventors' Patent-right Association, Limited.—This now well-known and ably conducted Association, the prospectus of which appears in the advertising columns, is, as may be seen from the list of recorded specifications, transacting a large patent business. Its organisation for obtaining patents combines so great economy in the charges with sterling efficiency, and its arrangements are so complete for unravelling disputed questions of patent-right, that it is gratifying to find former predictions as to its success fully borne out by the results. Members of the Inventors' Institute, to whom, moreover, it affords special advantages for obtaining and maintaining patent-rights, largely avail themselves of the services of the Association.

APPLICATIONS FOR LETTERS PATENT.

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and in the apparatus employed therefor.—2690. T. Jackson and T. Southan. The application of titanic iron ore in making and repairing bottoms of heating and reheating furnaces in place of sand in order to utilise the cinder from such furnaces for fettling puddling furnaces.—2691. B. Tomlinson. Corn and seed dressing and blowing machines.—2692. F. A. Gatty. Improvements in producing certain colours on cotton fabrics and yarns.—2693. S. J. Mackie. Manufacture and storing of gun-cotton.—2694. J. Hesselden. Improvements in the construction of twist lace machines.—2695. W. R. Lake. Machinery for manufacturing cotton and other fibrous materials (com.)—2696. A. J. Reynolds. An improved condensing steam pumping engine. (Complete Specification.)—2697. G. H. Procter. An improved spring hammer for planishing and hammering metals and other purposes.—2698. F. Wilkinson. Improvements in washing or scouring wool and woollen fabrics or yarns.—2699. W. J. Curtis. Improvements in the construction of the permanent way of railways and tramways and of the carriages to run thereon.—2700. A. V. Newton. Mowing machines (com.)—2701. J. H. Johnson. Improvements in bridges and viaducts, and in machinery or apparatus connected therewith (com.)

On September 12th.—2702. G. A. A. Cunningham and T. P. C. Cunningham. Electro-magnetic motors.—2703. J. Philpott. Glueing to be used in a cold state instead of hot glue, called adhesive liquid.—2704. J. Hargreaves and T. Robinson. Manufacture of sulphate of soda.—2705. J. Wood. Spring mattresses and other articles for sitting or reclining upon.—2706. W. Morgan-Brown. Wax thread sewing machines (com.)—2707. G. T. Bousfield. Improvements in lacing, and in the mode of lacing and fastening wearing apparel and other articles with the same (com.) (Complete Specification.)—2708. M. O. Camroux. Construction and arrangements of telescopic or sliding appliances for the protection of openings, passages, and places, and for other purposes where an elongation or reduction of length is required.—2709. W. H. Bailey and J. Westley. Lubricators for steam-engine and other cylinders.—2710. W. Van de Waal. Stays and corsets.—2711. W. D. Ruck. Manufacture of gas.—2712. J. H. Johnson. Improvements in effecting the purification of cast iron, malleable iron, cast steel, and malleable steel, and other metals or alloys (com.)

On September 13th.—2713. E. Hawkins. Compensating balances for chronometers, applicable also to other timekeepers.—2714. J. H. Johnson. Portfolio or case for containing valuable papers and documents (com.)—2715. W. S. Fish. Improvements in wicks.—2716. R. Clay. Printing machines.—2717. W. S. Dixon. Manufacture of plate iron or refined metal.—2718. M. Bebro. Mechanism or apparatus to be employed for numbering and printing tickets, cheques, and other similar and like articles progressively and consecutively.—2719. W. R. Lake. Process and compound for tempering and refining steel (com.)—2720. M. Evrard. Washing coal and minerals.—2721. J. H. F. Kienast. Apparatus for heating railway carriages by means of hot air.—2722. W. West. Fastenings for wearing apparel.—2723. H. A. Walker. Mechanism or apparatus for registering and checking the receipt of monies from persons entering theatres, music-halls, and other places where a check is required as a means of detecting fraud.—2724. S. J. Wells. Combination shirts.—2725. L. Hill. In apparatus for regulating the speed of marine engines.—2726. N. E. Stevens and C. Cullum. New or improved game or games for use in the open air, in rooms, or in other places, and in apparatus or appliances to be used therewith.—2727. N. E. Stevens and C. Cullum. Improvements in roller blinds.—2728. R. K. Jones. Apparatus to be used in discharging cargo from ships or vessels.—2729. J. J. Delmar. Mode of manufacturing carpet and other similar piled or looped fabrics.—2730. E. Holden. Process of preparing wool, cotton, and other fibres.—2731. R. C. Hodges. Means of and apparatus for turning over the leaves of music and other books and periodicals.—2732. W. Stubbleford. Apparatus for securing automatic couplings used on the ends of railway carriages.—2733. H. E. Mines. Kitchen ranges.—2734. W. R. Lake. Wire ties for securing bales of cotton and other merchandise (com.)

On September 14th.—2735. W. Morgan-Brown. Improved machine for attaching buttons (com.)—2736. W. Morgan-Brown. Improved machine for nailing heels to boots and shoes and trimming the edges thereof (com.) (Complete Specification.)—2737. T. H. Rushton and J. Macqueen. Improvements in machinery for combing cotton and other fibrous substances.—2738. E. Zahn. An improved combined bag and muff.—2739. W. Morgan-Brown. Telegraph apparatus (com.)—2740. W. R. Lake. Improved elastic material, and method of manufacturing the same, for stuffing mattresses, sofas, and chairs, and for other like purposes (com.)—2741. W. R. Lake. Chimneys and fireplaces, and in ventilating appliances to be used in connection therewith (com.) (Complete Specification.)—2742. T. B. Gibbs. Domestic fire-grates or stoves, and in appliances connected therewith, for heating or warming rooms or apartments.

On September 16th.—2743. J. Beckett. Improved system for "washing," "toning," "washing," "fixing," and "washing" photographic prints, and apparatus therefor.—2744. T. H. S. Haley and S. H. Haley. Improved valve for regulating the supply of steam to the cylinder or cylinders of steam-engines.—2745. E. T. Hughes. Manufacture of the salts, carbonates, and hydrates of baryta and strontia, and also for improved modes of making baryta and strontia caustic (com.)—2746. E. T. Hughes. The treatment of greasy and washing liquors used in scouring or cleaning wool by caustic baryta or strontia (com.)—2747. N. J. Suckling. Boilers, and in means for producing constant circulation of water therein.—2748. A. C. Rand. Compressing air, and in the apparatus employed therefor.

On September 17th.—2749. F. F. E. Hooper. Utilising and economising the motive-power of water or other liquid, and applying the same with augmented force to the purposes of setting machinery in motion, and to execute other work.—2750. J. Atkinson. Improved washing machine.—2751. J. Black. New or improved machine for lining or covering pasteboard, cardboard, strawboard, paper, and other articles with linen, fancy paper, and similar materials.—2752. A. Smyth and C. T. Ramsay. Apparatus for stoving or drying wool, cotton, and other like materials, also grain and other like substances.—2753. G. Chappell. Chaplets or studs used in casting pipes and other hollow articles.—2754. E. D. Barker. Means and apparatus for actuating railway breaks.—2755. K. Robison. Manufacture of fans for ladies' use.—2756. B. Shepherd and F. Stuckey. Machinery or apparatus for tunnelling and excavating, and for other like uses.—2757. J. Middlemass. Improvements in clerical costume.—2758. S. Edmiston. Knapsacks and other analogous articles, for the purpose of more conveniently supporting the weight thereof while being carried on the back.—2759. A. V. Newton. Improved mechanism for driving sewing and other machines (com.)

On September 18th.—2760. J. T. Wibberley. Machinery or apparatus for winding cotton, silk, wool, or other threads on spools or reels.—2761. B. Hunt. Apparatus for producing ice (com.)—2762. W. H. Hammond. Construction of busks or fastenings for stays or corsets.—2763. E. J. C. Welch. Construction of apparatus for straining and winding wire for fencing and other purposes.—2764. W. Osborn. Locks.—2765. G. Read and J. J. Nickoll. Improved method of and apparatus for signalling, applicable to use in ships or on land.—2766. W. E. Newton. Preparation of explosive compounds (com.)—2767. J. Mitchell and W. E. Newton. Machinery for the manufacture of railway and other carriage springs.—2768. L. Heinemann and M. L. Müller. Apparatus for composing type.—2769. J. A. Cox. New method of providing a means of affixing the Government stamp to licensed victuallers' and other glasses used for the sale of malt and other liquors.—2770. A. F. Webb. Treating oils, spirits, and fatty matters, whereby they are rendered disinfecting and deodorising during the combustion thereof, and by which the said oils are purified.—2771. I. L. Pulvermacher. Electro-conducting and electro-generating apparatus or appliances for medico-electric and other purposes, and in apparatus for measuring and graduating electric currents.

On September 19th.—2772. J. W. Gray. Explosive compound (com.)—2773. T. Lowe. Apparatus for facilitating breathing in impure atmospheres.—2774. W. Eden. Steam boilers.—2775. G. H. Rippin and E. G. Rippin. Improvements in mechanism or apparatus to be employed in the processes of preparing, spinning, and weaving cotton or other fibrous substances.—2776. G. Keighley. Looms for weaving.—2777. J. Taylor. Steam generators.—2778. E. Thornton. Cooking apparatus or kitchen ranges.—2779. A. C. Fraser. Retorts for the manufacture of gas.—2780. J. Mason. Metallic pens and penholders, and in presses or machines for the manufacture of metallic pens and penholders.—2781. W. R. Lake. Button-hole sewing machines (com.)—2782. G. H. Smith. Improved method of treating brick, porous stone, and other like materials to increase their hardness, durability, and impermeability.—2783. J. H. Valleton and J. E. Planque. Manufacture of bread, biscuits, and pastry. (Complete Specification.)—2784. A. V. Newton. Air engines (com.)—2785. A. M. Clark. Apparatus for propelling vessels (com.)

On September 20th.—2786. P. P. F. Michéa. New substances for dyeing, printing, and tanning, and the process employed for treating one of such substances. (Complete Specification.)—2787. P. P. F. Michéa. New substances for dyeing, printing, and tanning, also applicable for the manufacture of paper and threads or yarns. (Complete Specification.)—2788. P. McLaurin. The pasting of paper, and in the machinery or apparatus employed therefor.—2789. W. Bayliss. Steam boilers.—2790. R. Stone. Artificial fuel.—2791. J. S. Story and F. G. Lynde. Machinery for excavating.—2792. J. A. Wood. Rotary plough.—2793. M. P. Manfield. Boots and shoes.—2794. M. Henry. Mode of and apparatus for propelling ships and other vessels (com.)—2795. E. S. Bigg and W. F. Hunt. Mode of and apparatus for manufacturing plaited paper cups, holders, or cases for holding confectionery, and also other plaited, goffered, puckered, or folded articles for various purposes.

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On September 23rd.—2802. C. Wassall. An improved dress suspender.—2803. R. Bocklen. Machinery for rolling screws and metal rods.—2804. E. G. Brewer. Gloves (com.)—2805. W. Rath. Annealing and removing of oxide or scale from iron and steel wire and other articles of iron and steel.—2806. C. G. Morgan. Fastenings for window sashes and for other purposes.—2807. T. Wheelhouse. Means or apparatus for "unhairing," "fleshing," and "working" hides.—2808. A. J. P. de Carvalho. Improved mechanical beam or girder. (Complete Specification.)—2809. A. M. Clark. Elevating apparatus for builders', firemen's, and other purposes (com.)—2810. R. Wappenstein. Apparatus to be used in connection with mechanism for registering and indicating the number of persons entering and leaving omnibuses, steamboats, theatres, and similar places.

On September 24th.—2811. G. Yule. New appliance or apparatus applicable to or an improvement in cylindrical and other rulers for office and general use.—2812. T. Dale. Steam boilers.—2813. E. Taylor. Stuffing beds, mattresses, paillasses, cushions, pillows, &c., with ground or granulated cork or other light bark or wood.—2814. R. King. Improved gas regulator.—2815. C. Owen. Improved means for the better prevention of accidents in railway tunnels.—2816. W. T. Bury. Covers for melting furnaces.—2817. W. Fair. Machinery for steering ships.—2818. W. R. Lake. Mechanism to be used as an attachment to a sewing machine for hemming, creasing, binding, banding, fold-making, cording, and quilting (com.) (Complete Specification.)—2819,

J. G. Tongue. Producing mixed printed and dyed parti-coloured or shaded threads and fabrics of silk, wool, cotton, flax, or other fibrous materials (com.)—2820. W. F. Reynolds. Improved means of and apparatus for adjusting ships' compasses.—2821. E. J. Lindsay. Toy row-boat.—2822. C. Morfit. The reclamation of materials employed in the manufacture of di-phosphate and tri-phosphate of lime.—2823. R. Young and P. Brash. Kilns for burning lime.—2824. J. K. Sax. Manufacture of railway wheels, and in apparatus therefor. (Complete Specification.)—2825. A. L. Franklin. Manufacture of elastic fabric.

On September 25th.—2826. G. Pickin. Lamp chimneys.—2827. C. J. A. Dick and G. A. Dick. Manufacture of wires applicable to telegraphic purposes. (Complete Specification.)—2828. T. J. Martin and J. M. Harper. Application of steam for various purposes.—2829. J. Shields. Combing fringes of textile fabrics, and in the machinery or apparatus employed therefor.—2830. G. Smith. Enamelling stoneware, Bristol ware, and other earthenware of the like nature.—2831. W. R. Lake. Sewing machines (com.)—2832. E. W. Hughes. Improvements in the construction of tramways, and carriages for the same.—2833. E. T. Hughes. Printing, impressing, or enamelling on paper, glass, crystal, wood, porcelain, and all descriptions of materials (com.)—2834. H. B. Barlow. Construction of spanners and screw keys (com.)—2835. S. Mayall and I. Smith. Roving, spinning, and doubling.—2836. W. R. Lake. Rakes for reaping machines (com.)—2837. H. H. Murdoch. New or improved loom for weaving embroidered work or tapestry (com.)—2838. P. J. Davies. Improved regulating and shut-off apparatus for liquids.—2839. G. S. Hill. Obtaining motive-power, and in machinery or apparatus for the same.

On September 26th.—2840. R. J. Lees and J. H. Garforth. Fuel economisers.—2841. W. T. Sugg. Apparatus for regulating the supply of gas.—2842. J. Mason. Manufacture of metallic pens, parts of which improvements may also be applied to the manufacture of the metallic parts of penholders and to wood screws.—2843. W. H. Fellows. Manufacture of mouth-pieces for smoking purposes.—2844. G. Pigott. Wringing and mangling machines.—2845. F. Walton. Oxidising oil, and in machinery to be employed for that purpose.—2846. J. Maddock. Apparatus for controlling and locking railway signals.—2847. C. W. Harrison and A. H. Harrison. Improvements in combining atmospheric air and certain gases for lighting and heating purposes.

On September 27th.—2848. R. H. Courtenay. Producing and using surface blocks for line and photographic printing from nature.—2849. S. Lewin. Thrashing and stacking machine.—2850. H. Lander. Pitching hay and loading waggons.—2851. W. E. Wiley. Metallic pens, and in penholders.—2852. H. Ramston. Apparatus for laying out courses, bearings, or a ship's position upon a chart.—2853. J. Burnie. Portable fencing.—2854. J. Bartlett. Machine for mixing teas, coffees, and granular substances.—2855. J. McKelvie. Gas.—2856. Sir. E. F. Piers, Baronet, and J. S. Armitage. Breech-loading fire-arms.

On September 28th.—2857. J. Holt. Drawing of flat or nearly flat wire, or of triangular or sectoral wire.—2858. W. H. Hacking and T. Hacking, and J. Mallison. Sizing machines, parts of which are applicable to drying machines for yarn and textile fabrics.—2859. E. J. Cain. Construction of enclosed screens, with dust-bins for domestic and other purposes.—2860. W. A. Gilbee. Time-fuse for shell for breech and muzzle loading ordnance (com.)—2861. C. W. Siemens. Production of iron and steel, and in furnaces or apparatus employed for that purpose.—2862. H. Smith. Blowers and brushes for mills for grinding grain and other substances, a part of which improvements may also be applied to the manufacture of brushes for various purposes.—2863. T. Kay. Consumption of smoke in steam-boiler furnaces.—2864. C. Kastenbein. Composing and distributing type.—2865. R. Veitch. Cure of corns by friction in the form of a powder. (Complete Specification.)—2866. H. E. Brown. Locks or fastenings for the doors of pleasure carriages.—2867. I. B. Harris. Material for use as packing for the piston-rods of steam-engines and like uses.—2868. T. Davidson. Fabric applicable for use in the manufacture of ladies' mantles, tippets, carriage and other cloaks, rugs and other articles.—2869. J. H. A. Gericke. Governors.

On September 30th.—2870. B. Haas. Watches, showing the date of the month and days of the week.—2871. F. Perron and A. Bonnardot. Manufacture of boots and gaiters or legging combined.—2872. C. Houston. Appliances for regulating the speed of steam-engines.—2873. J. Newsome and J. Overend. Steam-engines.—2874. S. Swain. Gas fittings.—2875. H. Boyle. Regulating the heat of bodies of air or water by means of a reservoir of compressed water (or air) and a self-acting regulator of mercury, constructed to maintain with accuracy any degree of heat within 212° Fahrenheit.—2876. H. Boyle. Hatching eggs by means of a reservoir of compressed water (or air) and a self-acting regulator of mercury, constructed to maintain with accuracy any degree of heat required within 212° Fahrenheit.—2877. J. Price and J. Wilkins. Drawing wire.—2878. F. Goodacre. Leggings.—2879. J. L. Adam. Tap for drawing off liquids.—2880. O. Schulze. Penholders, cigar and cigarette holders, and in the manufacture thereof (com.)—2881. J. Fottrell. Manufacture of Val de Travers rock pavement.—2882. A. M. Clark. Bearings for spindles and shafts (com.)—2883. C. D. Abel. Traction engines, which may be also used as portable engines (com.)

On October 1st.—2884. J. Hodkinson and D. Clarke. Machinery for the manufacture of metal laths for Venetian window-blinds or sunshades. (Complete Specification.)—2885. C. H. Hall. Steam pumps, or apparatus for elevating fluids by steam. (Complete Specification.)—2886. G. Rydill. Hydro-extractors or centrifugal machines for obtaining and applying motive-power for the purpose of draining and drying animal and vegetable substances, earths, and compositions.—2887. A. Chapman. Apparatus for evaporating and concentrating cane juice and other saccharine solutions, and for the evaporation of liquids.—2888. B. J. Kerridge. Lowering boats from ships and other vessels.—2889. E. T. Hughes. Machinery for opening, dividing, and incorporating solid, liquid, and aeriform matters, and also for the evaporation and distillation of fluids and the acceleration of chemical processes (com.)—2890. C. F. Gurdon. Spring safety-valves for steam-boilers.—2891. W. S. Allardyce. Closets, commodes, privies, and such like.—2892. J. B. Jessop. Fire-lighters.—2893. J. M. Lasché. Impermeable fabrics or materials for hangings and other purposes.—2894. A. Ransome. Sand-papering machinery.—2895. E. T. Hughes. Jointing and fastening together the ends of the rails or bars of railways (com.)—2896. W. Bryant. Splints for matches.—2897. H. Bessemer. Construction of sea-going passenger steam vessels.—2898. A. M. Clark. Punching the cards of jacquard mechanism (com.)

On October 2nd.—2899. F. Shanks and R. Shanks. Landaus and open-headed carriages.—2900. E. G. Brewer. Construction of studs or buttons (com.)—2901. W. Whittle. Boilers.—2902. J. T. Davies. Curing and packing hams and bacon (com.)—2903. M. Henry. Sewing machines (com.)—2904. W. R. Watson. Treatment of fibre-bearing plants, and in the machinery or apparatus employed therefor.—2905. W. Turner and J. Pridmore. Carding engines for carding cotton, cotton and silk waste, and other fibrous materials.—2906. W. R. Lake. Wheels for vehicles (com.)—2907. T. Cox and W. Holland. Runners and top notches for umbrellas and parasols.—2908. H. H. Murdock. Self-acting mules (com.)—2909. C. A. C. Eckhold. Means and apparatus for measuring distances, altitudes, and angles.—2910. W. Campbell. Furnaces for steam boilers, and other purposes.

On October 3rd.—2911. H. A. Bonneville. Metal lashing for ship's stays (com.)—2912. F. Haseldine. Multitubular steam boilers.—2913. H. B. Barnett and W. B. M. Slade. Preparation or production of disinfecting, antiseptic, and cleansing liquids.—2914. D. R. Ratcliffe. Preventing the explosion of gunpowder.—2915. B. Hunt. Printing and ornamenting surfaces (com.)—2916. E. T. Hughes. Sewing machines (com.)—2917. W. Rowlandson. Machine for cleaning skins.—2918. C. H. Southall. Machinery for rivetting the soles of boots and shoes to the uppers, and paring and finishing the edges of the soles and heels, and finishing the bottoms.—2919. J. Barbour. Hackling machine holders, and in the mode of screwing the material to be hackled therein.—2920. J. Saunders and J. Piper. Coating tin and terne plates.—2921. W. E. Gedge. Hydraulic auto-motor motive-power engine (com.)—2922. W. E. Gedge. Feed surfaces for sewing or embroidery machines (com.)—2923. C. H. Siemens. Electrical step-by-step instruments and apparatus for giving and receiving telegraphic messages, and for communicating signals and controlling point and signal apparatus on railways, also partly applicable to other signalling purposes (com.)—2924. L. W. Boynton. Improvements in the manufacture of blocks or cubical or other shaped pieces of coal, sugar, clay, peat, manure, and other materials, and in machinery therefor.—2925. E. G. Brewer. Machinery for the manufacture of rivets, bolts, metal covers, and other articles produced by stamping (com.

On October 4th.—2926. W. E. Gedge. Stereoscopic apparatus (com.)—2927. J. Wadsworth. Fastening or connecting hooks and loops applicable for fastening certain parts of dresses, and attaching price tickets to fancy articles exposed for sale, and for other like useful purposes.—2928. J. W. Hickman. Taps or cocks for drawing off fluids and liquids.—2929. E. Gray. Hydrostatic governors for marine engines.—2930. J. G. N. Alleyne. Apparatus for the manufacture and refining of sugar and rum or other spirit.—2931. J. Nicholson and G. Skinner. Improved steam generator or boiler.—2932. G. B. Capel. Fittings of ships to be used to carry earth oil and other liquids.—2933. W. R. Lake. Spindles for spinning machines, and in apparatus connected therewith (com.)—2934. H. B. Barnett and W. B. M. Slade. Manufacture of fluids for deodorising and disinfecting purposes.—2935. W. Carwood. Presses for embossing and printing, and in the mode of working the same.—2936. W. E. Newton. Governors or apparatus for regulating the speed of steam or other motive-power engines (com.)—2937. W. Moorison and J. Mitchell. Self-acting mules.—2938. R. H. Hampson. Construction of machinery or apparatus for the manufacture of cleaning waste.

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On October 7th.—2949. F. W. Follows, J. Bate, and S. Edwards. Chaff-cutting machines.—2950. T. Greener and W. Ellis. Manufacture of iron, and in the production of "fettling" for improving the quality and yield of iron in the process of reduction. (Complete Specification.)—2951. J. C. Meyer. Steam boilers, and in furnaces to be employed therewith.—2952. R. Mallet and H. Scholefield. Effecting the massing or agglomeration of mineral substances.—2953. W. Gardner. Safes, cash-boxes, jewel-boxes, and other similar receptacles for valuable property.—2954. J. Bailey. Supply of water to water-closets, urinals, and other places, and in apparatus therefor.

On October 8th.—2955. A. A. Cochrane. Boilers.—2956. C. Brokell. Drying of peat, and its manufacture or preparation into peat fuel, and in the application of the said fuel to the manufacture of iron from the ore, some parts of the said improvements being also applicable for drying other materials or substances.—2957. J. Buchanan. Propulsion of ships.—2958. S. Brooke. Carding engines.—2959. W. Lorberg. Manufacture of soap.—2960. F. Render. Dressing flour.—2961. J. Wilkinson, S. Fillingham, and J. Pardoe. Machinery or apparatus for scouring, preparing for printing, bleaching, cleansing, drying, and beaming worsted, woollen, or other yarns.—2962. T. Cox and W. Holland. Manufacture of runners and top notches for umbrellas and parasols.—2963. J. Cox. Machinery for the manufacture of rivets, bolts, and spikes.—2964. H. Larkin, A. Leighton, and W. White. Production of iron and steel.—2965. W. E. Gedge. A novel kind of tablets or dominoes with coloured dots or points for the game of dominoes (com.)—2966. J. M. Tremaux. Certain improved processes of exploring for water, of storing it in the earth, and of regulating irregular sources of supply.

On October 9th.—2967. A. Sauvée. Steam boilers (com.)—2968. A. J. Bernard. Lamps.—2969. J. Howe. Weaving textile fabrics.—2970. B. J. B. Mills. Electro-magnetic clocks (com.) (Complete Specification.)—2971. S. Danks. Compressing balls and blooms of iron or steel, and in ejecting apparatus for such machines.—2972. J. Kenyon. Construction of fire-grates for domestic purposes, which improvements are also applicable to fire-grates of the ordinary description.—2973. W. B. Chapin. Apparatus for operating railway brakes.—2974. B. Tanner. Manufacture of artificial manures.—2975. H. Clayton, H. Clayton, jun., and F. Howlett. Treating peat, and in apparatus employed therein.

On October 10th.—2976. W. D. Fisher. Apparatus for and connected with the manufacture

* "Com." means "Invention communicated from abroad."

and use of illuminating gas, parts of which are applicable to other purposes.—2977. R. Wilson Sweeping chimneys, and the protection of chimney cans from being blown off and falling to the ground.—2978. G. M. Hammer. School desks, and applicable to other uses.—2979. G. Rydill. Hydro-extractors or centrifugal machines for cleansing, draining, and drying sugar, wool, animal and vegetable substances, earths, compositions, and for other substances.—2980. R. R. Riches. Improvements in revolving rakes, and in the mechanism for working the same.—2981. J. Corry. Fire grates.—2982. J. Hargreaves and T. Robinson. Manufacture of alkalies, and in apparatus employed therein.—2983. R. Gastineau. Railway switches.—2984. J. Edwards Signal alarums for railway trains.—2985. A. Ungerer. Evaporating liquids, and means or apparatus to be employed therein.—2986 J Boyd. Machinery for winding or doubling yarns or threads. 2987. M Henry Apparatus for sustaining and insulating telegraph wires (com.)—2988. J. Young. Treating liquors containing ammoniacal compounds in order to obtain products therefrom.—2989 J Young Manufacture of carbonate of soda.—2990. R. Bagley. Holders or galleries for the shades or globes and chimneys of gas and other lamps, which improvements are also applicable to candle-holders.—2991. W. Astrop Means and apparatus for drying sewage and other like substances.—2992. J. F. Moss. School desks and seats.—2993. R. C. T. Baylis. Cutting boards and patterns employed for shaping various articles.—2994 G. Haseltine. Machines for sewing books, pamphlets, or sheets of paper (com.) (Complete Specification.)—2995. J. H. Dickson. Process of and machinery for treating or preparing fibre-yielding plants for the purpose of obtaining useful fibres therefrom.—2996. J. R. S. Hayward. Application of electricity to the cure of certain bodily ailments, and in apparatus for the same.

On October 11th.—2997. J. W. Perkins. Artificial fuel.—2998. W. D. Mann. Railway carriages and fittings.—2999 J C. Kay and W. Hartley. High-pressure and condensing or non-condensing steam-engines 3000 C. F. Clark. Charcoal box irons. 3001 P Balin. Hanging papers.—3002. W. C. Mann and G. Redihalgh. Hats, and machinery or apparatus employed in hat-making. 3003. J. Steadman. Obtaining acetic acid 3004. W. R. Lake. Steam generators (com.)—3005. C. Lowe. Treatment of coal gas tars for the purpose of obtaining certain useful products therefrom. 3006. T. Browning. Means or apparatus for drying various substances or materials.—3007. E. C. Nicholson. Separation of substances and products capable of being employed for the purposes of dyeing and printing.

On October 12th.—3008. W Ferrie. Applying combustible gases obtained from smelting furnaces, or from gas producers for heating puddling and other furnaces, and in apparatus connected therewith 3009. P Ritchie and A. Wyllie. Blocking and shaping Glengarry bonnets and other Scotch bonnets and caps, and in machinery or mechanism to be employed therefor.—3010. F. Preston. Steam boilers and furnaces, and apparatus connected therewith.—3011. W. O. Pooley and J. McDine. Machinery for cleaning and preparing cotton and other fibrous substances.—3012. E. Davies. Machinery for obtaining, utilising, transmitting, and applying motive power.—3013. T. Archer, jun Manufacture of pulleys for traction and other purposes.—3014. S. H. Johnson, F.C.S. Method of and apparatus for separating the soluble constituents of substances from the insoluble constituents.—3015. H. Chancellor. Machinery for the manufacture of hinges and other jointed metallic articles, and for other like purposes.—3016. E. O. W. Whitehouse and S. E. Phillips. Recording apparatus, specially applicable for the verification of fares in public vehicles.

On October 14th.—3017. N. Bickford. Manufacture of soap.—3018. G. Smith and J. Lewty. Improved self-acting nose peg.—3019. E. B. Gowland. Pianofortes.—3020. J. O. Spong. Apparatus for producing changes in representation, adapted to advertising and other uses.—3021. W. E. Gedge. Boots and shoes (com.)—3022. S. Corbett. Ploughs.—3023. C. Parkin.

(Continued on page 187)

The Scientific Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

AND

JOURNAL OF THE INVENTORS' INSTITUTE.

DECEMBER 2, 1872.

SCIENTIFIC WAGERING.

Not many days ago the virtuous indignation of the Lord Mayor and magistrates of London burst all bounds, alighting with furious force upon the betting-men who dared to congregate within the City, and pollute by their baleful presence an almost sacred locality, where nothing but the most honest and honourable dealing is ever heard of, where puffing spurious wares is a thing unknown, and "rigging the market," stock-jobbing operations, marine insurance frauds, and banking swindles are never practised, to say nothing of the daily buying in the cheapest (albeit, not the fairest or most honest) market, and selling in the dearest. However, this movement by the City magistracy is probably as much the consequence of a pressure from without, produced by the action of an improved moral tone of society, that many of our modern mentors—the newspapers—tell us now happily prevails, and is day by day more and more developed by the zealous exertions of Gladstone, Bruce, Ayrton, and Co. Without doubt the suppression of habitual and professional wagering or betting is probably as good a work to accomplish as the prevention of habitual drunkenness. Indeed, it may be said that wagering or betting under any circumstances is a senseless and pernicious practice of almost childish character, which the law does well to discourage.

The circumstance just alluded to, together with the fact that the name of that heresiarch of science, Mr. John Hampden, has been again brought before the public by the investigation by the Central Criminal Court of a charge of libelling Mr. Wallace, have led us to make the above remarks. Poor Mr. Hampden has a peculiar notion about this world of ours; he cannot believe it to be globular, and avers that Scripture (which he evidently consults as a teacher of science) forbids him to believe it, and his own view of common-sense forbids it also; for he opines that no one ever saw a man who could make it his daily practice to walk with his heels above his head, as must be the case with all of us at certain times and seasons if the Copernican theory be right and true; and he will not believe that such a state of things can be possible, notwithstanding he may have seen the common house-flies walking on the ceiling with their heads and backs downwards instead of upwards, as is the case with them at other times. Whether in accordance with the Scripture statement, "the four corners of the earth," Mr. Hampden believes the earth to be square as well as flat we do not know, but we suppose—as he is evidently a consistent man—he does; neither do we know what he considers to be the support of his flat world, or how, if he believes it to be self-supporting, he imagines that, if poised in space by a nearly even pressure on all points so as to produce equilibrium, anything else than a structure more or less globular could possibly be produced, though the simple experiment of rolling a piece of bread between his two hands would have taught him that a pill or globular body, and nothing else, would be produced by equal pressure on all points.

Not content with general assertions of disbelief of the Copernican theory, Mr. Hampden must needs challenge the whole world of science to prove to his satisfaction the rotundity of the earth; and, in order that he might secure someone to dispute with, he adopted the expedient of offering to wager £500; and, to bring this matter to a definite test, agreed to settle it by a decision as to certain specified questions; and so the objectionable practice of wagering or betting was brought into operation.

But betting, like quarrelling, is a game that requires two in order to play at it, and Mr. Hampden could not have carried out his bet unless he had someone to bet with him, and *this* he soon found, we are sorry to say, in the person of Mr. Wallace—a circumstance we much regret, because we hold *it* to be beneath the dignity of science to import the evil practices of the turf-ring into scientific discussions: the more so because scientific discussions have, or should have, regard to *facts*, and not to mere matters of chance. We lately had occasion to express our opinion on the subject of the dignity of men of science with reference to the behaviour of Mr. Ayrton when dealing with Dr. Hooker; but what dignity will remain to scientific men if wagering and betting become the concomitants of scientific disputes, and the manners and customs of the turf-ring are adopted by men of science? To our minds the moral is this:—Poor Mr. Hampden has lost his £500, and Mr. Wallace has had to submit to all kinds of unpleasantnesses, the whole being the result of the adoption of wagering or betting, a thing that ought never to be permitted to enter the arena of science.

Reviews.

Vaccination and the Vaccination Laws; A Physical Curse, and a Class-Tyranny. By the Rev. WILLIAM HUME-ROTHERY (a Clergyman of the Church of England, who gave evidence last year before the Select Committee of the House of Commons on Vaccination). Manchester: Printed by W. Tolley, 7, Spring Gardens.

Speech of Mr. Jacob Bright, M.P., in the debate on the Contagious Diseases Acts (House of Commons, Monday, July 22nd, 1872).—Speech of Mr. MUNDELLA in the same debate.

THESE pamphlets have reference to questions of most momentous character, whether considered in their social or scientific aspects. The latter of these being more within our province than the former is the one we shall now deal with, and in so doing limit ourselves to the practical question of efficacy or non-efficacy of the Vaccination Acts and Contagious Diseases Acts as systems for preventing the spread of fearful diseases of loathsome character. In these days of scepticism, all but universal, we ought not to be surprised to find a large number of persons who deny that any practical benefit results from the adoption of those systems, stoutly maintaining that they are not only useless for effecting their professed objects, but that they introduce a "remedy which is worse than the disease." Religious, moral, and sentimental objections are likewise urged against those systems, but these we shall not attempt to confute, for we hold that if proved to be efficacious as preservatives of the public health wise legislators must perforce uphold them as of high practical importance to the interests of the community, regardless of any transcendental notions of morality or sentimentality.

As regards Mr. Rothery's pamphlet on vaccination we must admit that he makes out a strong case *contra*; but we do not deem it conclusive, for his principal practical point, the non-success of vaccination in a number of instances, does not prove its inefficiency in the majority of cases; for such non-success is just equivalent to the fact that many well-acknowledged as ordinarily successful plans of curing other diseases are often applied with such ill-success that the patient dies in consequence of the disease instead of being cured.

But the anti-vaccine objection that the introduction of the vaccine lymph into the system is often the means of introducing foreign diseases into the system of the person vaccinated is a very important practical question; though to our mind this merely teaches that great care and pains ought to be taken to procure perfectly pure lymph.

Mr. Jacob Bright and Mr. Mundella in their opposition to the Contagious Diseases Act do not much rely on the practical inutility of the Act, for they employ nearly all their power on the sentimental objections to its operation, the string they harp on being the lowering effect on female modesty which they say results from the statutory system of compulsory medical examination and treatment; and in order to make out a good case they dilate on instances where the Act has been shamefully abused by being applied by stupid policemen to women who were not of the unfortunate class. Doubtless the weak place in the system is that it has to be carried out by common policemen, and is, perhaps, not sufficiently guarded against abuse; but as it seems to be now well-accepted that the duty of the policeman is not so much to guard us against murder, robbery, and assault, in which he continually proves his inefficiency, as to look after our sobriety, decorous demeanour, and propriety of language, the conclusion seems to be that the remedy here lies in elevating the character of the official so that he may be fully competent to perform his work without blundering or needless offence—that is, if the country will pay the wages of such high-class men as our police-constables would then be. And if really so great an injury be worked as is alleged, it looks very much like a charge against the medical profession, because it is clear that in this matter they ought to "do their spiriting gently," since it is evident the proceedings must necessarily be offensive. The whole difficulty, however, is much magnified, for, whilst Englishwomen are content to be attended in childbirth by male accoucheurs, and are ever ready voluntarily to submit to medical examination by male doctors, it cannot be anything more than a mere feminine affectation of modesty on the part of women who do not mind violating chastity to elevate a disagreeable proceeding into a shock to their delicacy of feeling. One portion of Mr. Jacob Bright's speech is very remarkable, for he makes it appear that he regards with great tenderness those women who only "indulge in the occasional gratification of their passions," entertaining, we assume, the idea that it is only the too frequent repetition of such gratifications that is the injury, and that these occasional wrong-doers are not likely to be diseased, though there is really no sound reason for this view of the matter. If the class of diseases which this Act deals with could be confined to the persons who originate them, then Government interference would be unjustifiable; but as they are in fact frequently communicated to innocent women, and transmitted to equally innocent offspring, and are a rottenness in the bones of the nation, measures for preventing the spread of them are more than justified *malgré* all sentimentality and fancied injury to modesty.

The Expression of the Emotions in Man and Animals. By CHARLES DARWIN, M.A., F.R.S., &c., with photographic and other illustrations. London: John Murray, Albemarle Street. 1872.

ALTHOUGH this is a physiological work of the highest order, such as might be expected to proceed from the pen of this eminent *savant*, it is nevertheless a pleasant, readable book; to our mind, quite as interesting as any three volume novel, and withal far more instructive. Throughout its pages references are continually made to the habits and actions of cats, dogs, and other animals, such as all of us have many opportunities of testing by our own observation.

The philosophic *rationale* of the book will be best understood by the quotation of the opening portion of chapter 1:—

The three principles which appear to me to account for most of the expressions and gestures involuntarily used by man and the lower animals under the influence of various emotions and sensations.—Mr Herbert Spencer ("Essays," Second Series, 1863, p. 138) has drawn a clear distinction between emotions and sensations, the latter being "generated in our corporeal framework." He classes as feelings both emotions and sensations. I arrived, however, at these three principles only at the close of my observations. They will be discussed in the present and two following chapters in a general manner. Facts observed both with man and the lower animals will here be made use of; but the latter facts are preferable, as less likely to deceive us. In the fourth and fifth chapters I will describe the special expressions of some of the lower animals, and in the succeeding chapters those of man. Everyone will thus be able to judge for himself how far my three principles throw light on the theory of the subject. It appears to me that so many expressions are thus explained in a fairly satisfactory manner, that probably all will hereafter be found to come under the same or closely analogous heads. I need hardly premise that movements or changes in any part of the body—as the wagging of a dog's tail, the drawing back of a horse's ears, the shrugging of a man's shoulders, or the dilatation of the capillary vessels of the skin—may all equally well serve for expression. The three principles are as follows:—

1. The principle of serviceable associated habits.—Certain complex actions are of direct or indirect service under certain states of the mind, in order to relieve or gratify certain sensations, desires, &c.; and whenever the same state of mind is induced, however feebly, there is a tendency through the force of habit and association for the same movements to be performed, though they may not then be of the least use. Some actions ordinarily associated through habit with certain states of the mind may be partially repressed through the will, and in such cases the muscles which are least under the separate control of the will are the most liable still to act, causing movements which we recognise as expressive. In certain other cases the checking of one habitual movement requires other slight movements; and these are likewise expressive.

2. The principle of antithesis. — Certain states of the mind lead to certain habitual actions, which are of service, as under our first principle. Now, when a directly opposite state of mind is induced, there is a strong and involuntary tendency to the performance of movements of a directly opposite nature, though these are of no use; and such movements are in some cases highly expressive.

3. The principle of actions due to the constitution of the nervous system, independently from the first of the will, and independently to a certain extent of habit.—When the sensorium is strongly excited nerve-force is generated in excess, and is transmitted in certain definite directions, depending on the connection of the nerve-cells, and partly on habit. or the supply of nerve-force may, as it appears, be interrupted. Effects are thus produced which we recognise as expressive. This third principle may, for the sake of brevity, be called that of the direct action of the nervous system.

These principles Mr. Darwin supports by numerous references to the habitual practices of the lower animals and of man.

With regard to the first of the principles above stated there is little said that is specially noteworthy, probably in consequence of its almost self-evident character; but as regards the second principle Mr. Darwin gives many instances in support of his theory; amongst others this one --

I will here give one other instance of antithesis in expression. I formerly possessed a large dog, who, like every other dog, was much pleased to go out walking. He showed his pleasure by trotting gravely before me with high steps, head much raised, moderately erected ears, and tail carried aloft, but not stiffly. Not far from my house a path branches off to the right, leading to the hot-house, which I used often to visit for a few moments, to look at my experimental plants. This was always a great disappointment to the dog, as he did not know whether I should continue my walk; and the instantaneous and complete change of expression which came over him as soon as my body swerved in the least towards the path (and I sometimes tried this as an experiment) was laughable. His look of dejection was known to every member of the family, and was called his *hot-house face*. This consisted in the head drooping much, the whole body sinking a little and remaining motionless; the ears and tail falling suddenly down, but the tail was by no means wagged. With the falling of the ears and of his great chaps the eyes became much changed in appearance, and I fancied that they looked less bright. His aspect was that of piteous, hopeless dejection; and it was, as I have said, laughable, as the cause was so slight. Every detail in his attitude was in complete opposition to his former joyful yet dignified bearing, and can be explained, as it appears to me, in no other way except through the principle of antithesis. Had not the change been so instantaneous, I should have attributed it to his lowered spirits affecting, as in the case of man, the nervous system and circulation, and consequently the tone of his whole muscular frame; and this may have been in part the cause.

As to the origin of these antithetical signs, Mr. Darwin remarks:—

Many signs, moreover, which plainly stand in opposition to each other, appear to have had on both sides a significant origin. This seems to hold good with the signs used by the deaf and dumb for light and darkness, for strength and weakness, &c. In a future chapter I shall endeavour to show that the opposite gestures of affirmation and negation—namely, vertically nodding and laterally shaking the head—have both probably had a natural beginning. The waving of the hand from right to left, which is used as a negative by some savages, may have been invented in imitation of shaking the head; but whether the opposite movement of waving the hand in a straight line from the face, which is used in affirmation, has arisen through antithesis or in some quite distinct manner is doubtful.

As to the third principle referred to—namely, certain actions which we recognise as expressive of certain states of the mind—they are, says Mr. Darwin, the direct result of the constitution of the nervous system, and have been from the first independent of the will, and, to a large extent, of habit. When the sensorium is strongly excited nerve-force is generated in excess, and is transmitted in certain directions, dependent on the connection of the nerve-cells, and, as far as the muscular system is concerned, on the nature of the movements which have been habitually practised. Or the supply of nerve-force may, as it appears, be interrupted. Of course every movement which we make is determined by the constitution of the nervous system; but actions performed in obedience to the will, or through habit, or through the principle of antithesis, are here as far as possible excluded Our present subject is very obscure, but, from its importance, must be discussed at some little length: and it is always advisable to perceive clearly our ignorance.

The most striking case, though a rare and abnormal one, which can be adduced of the direct influence of the nervous system when strongly affected on the body, is the loss of colour in the hair, which has occasionally been observed after extreme terror or grief. One authentic instance has been recorded in the case of a man brought out for execution in India, in which the change of colour was so rapid that it was perceptible to the eye.

Another good case is that of the trembling of the muscles, which is common to man and to many, or most, of the lower animals. Trembling is of no service, often of much disservice, and cannot have been at first acquired through the will, and then rendered habitual in association with any emotion. I am assured by an eminent authority that young children do not tremble, but go into convulsions, under the circumstances which would induce excessive trembling in adults. Trembling is excited in different individuals in very different degrees and by the most diversified causes — by cold to the surface before fever-fits, although the temperature of the body is then above the normal standard; in blood-poisoning, delirium tremens, and other diseases; by general failure of power in old age; by exhaustion after excessive fatigue; locally from severe injuries, such as burns; and, in an especial manner, by the passage of a catheter. Of all emotions, fear notoriously is the most apt to induce trembling; but so do occasionally great anger and joy. I remember once seeing a boy who had just shot his first snipe on the wing, and his hands trembled to such a degree from delight that he could not for some time reload his gun; and I have heard of an exactly similar case with an Australian savage to whom a gun had been lent. Fine music, from the vague emotions thus excited, causes a shiver to run down the backs of some persons. There seems to be very little in common in the above several physical causes and emotions to account for trembling; and Sir J. Paget, to whom I am indebted for several of the above statements, informs me that the subject is a very obscure one. As trembling is sometimes caused by rage, long before exhaustion can have set in, and as it sometimes accompanies great joy, it would appear that any strong excitement of the nervous system interrupts the steady flow of nerve-force to the muscles.

The manner in which the secretions of the alimentary canal and of certain glands—as the liver, kidneys, or mammæ—are affected by strong emotions is another excellent instance of the direct action of the sensorium on these organs, independently of the will or of any serviceable associated habit. There is the greatest difference in different persons in the parts which are thus affected, and in the degree of their affection.

The heart, which goes on uninterruptedly beating night and day in so wonderful a manner, is extremely sensitive to external stimulants. The great physiologist, Claude Bernard, has shown how the least excitement of a sensitive nerve re-acts on the heart, even when a nerve is touched so slightly that no pain can possibly be felt by the animal under experiment. Hence when the mind is strongly excited we might expect that it would instantly affect in a direct manner the heart; and this is universally acknowledged and felt to be the case. Claude Bernard also repeatedly insists, and this deserves especial notice, that when the heart is affected it re-acts on the brain, and the state of the brain again re-acts through the pneumo-gastric nerve on the heart; so that under any excitement there will be much mutual action and re-action between these the two most important organs of the body.

The vaso-motor system, which regulates the diameter of the small arteries, is directly acted on by the sensorium, as we see when a man blushes from shame; but in this latter case the checked transmission of nerve-force to the vessels of the face can, I think, be partly explained in a curious manner through habit. We shall also be able to throw some light, though very little, on the involuntary erection of the hair under the emotions of terror and rage. The secretion of tears depends, no doubt, on the connection of certain nerve-cells, but here again we can trace some few of the steps by which the flow of nerve-force through the requisite channels has become habitual under certain emotions.

A brief consideration of the outward signs of some of the stronger sensations and emotions will best serve to show us, although vaguely, in how complex a manner the principle under consideration of the direct action of the excited nervous system on the body is combined with the principle of habitually associated, serviceable movements.

When animals suffer from an agony of pain they generally writhe about with frightful contortions; and those which habitually use their voices utter piercing cries or groans. Almost every muscle of the body is brought into strong action. With man the mouth may be closely compressed, or more commonly the lips are retracted, with the teeth clenched or ground together. There is said to be "gnashing of teeth" in hell, and I have plainly heard the grinding of the molar teeth of a cow, which was suffering acutely from inflammation of the bowels. The female hippopotamus in the Zoological Gardens, when she produced her young, suffered greatly; she incessantly walked about, or rolled on her sides, opening and closing her jaws, and clattering her teeth together. With man the eyes stare wildly as in horrified astonishment, or the brows are heavily contracted. Perspiration bathes the body, and drops trickle down the face. The circulation and respiration are much affected. Hence the nostrils are generally dilated and often quiver; or the breath may be held until the blood stagnates in the purple face. If the agony be severe and prolonged these signs all change; utter prostration follows, with fainting or convulsions.

A sensitive nerve when irritated transmits some influence to the nerve-cell, whence it proceeds; and this transmits its influence, first to the corresponding nerve-cell on the opposite side of the body, and then upwards and downwards along the cerebro-spinal column to other nerve-cells, to a greater or less extent, according to the strength of the excitement; so that, ultimately, the whole nervous system may be affected. This involuntary transmission of nerve-force may or may not be accompanied by consciousness. Why the irritation of a nerve-cell should generate or liberate nerve-force is not known; but that this is the case seems to be the conclusion arrived at by all the greatest physiologists, such as Muller, Virchow, Bernard, &c. As Mr. Herbert Spencer remarks, it may be received as an "unquestionable truth that at any moment the existing quantity of liberated nerve-force, which in an inscrutable way produces in us the state we call feeling, must expend itself in some direction—must generate an equivalent manifestation of force somewhere"; so that when the cerebro-spinal system is highly excited and nerve-force is liberated in excess it may be expended in intense sensations, active thought, violent movements, or increased activity of the glands. Mr. Spencer further maintains that an "overflow of nerve-force, undirected by any motive, will manifestly take the most habitual routes; and, if these do not suffice, will next overflow into the less habitual ones." Consequently the facial and respiratory muscles, which are the most used, will be apt to be first brought into action; then those of the upper extremities, next those of the lower, and finally those of the whole body.

These views Mr. Darwin proceeds to elucidate in a way that may be fairly termed captivating, making repeated references to the various photographic illustrations of the work, the portions of which following the part from which we have quoted having reference to the means of expression in animals—the special expressions of animals and of man; the book finishing with concluding remarks, and a summary, from which we extract the following:—

The movements of expression in the face and body, whatever their origin may have been, are in themselves of much importance for our welfare. They serve as the first means of communication between the mother and her infant; she smiles approval, and thus encourages her child on the right path, or frowns disapproval. We readily perceive sympathy in others by their expression; our sufferings are thus mitigated and our pleasures increased, and mutual good feeling is thus strengthened. The movements of expression give vividness and energy to our spoken words. They reveal the thoughts and intentions of others more truly than do words, which may be falsified. Whatever amount of truth the so-called science of physiognomy may contain appears to depend, as Haller long ago remarked, on different persons bringing into frequent use different facial muscles, according to their dispositions; the development of these muscles being perhaps thus increased, and the lines or furrows on the face, due to their habitual contraction, being thus rendered deeper and more conspicuous. The free expression by outward signs of an emotion intensifies it. On the other hand, the repression, as far as this is possible, of all outward signs softens our emotions. He who gives way to violent gestures will increase his rage; he who does not control the signs of fear will experience fear in a greater degree; and he who remains passive when overwhelmed with grief loses his best chance of recovering elasticity of mind. These results follow partly from the intimate relation which exists between almost all the emotions and their outward manifestations, and partly from the direct influence of exertion on the heart, and consequently on the brain. Even the simulation of an emotion tends to arouse it in our minds. Shakespeare, who from his wonderful knowledge of the human mind ought to be an excellent judge, says:—

"Is it not monstrous that this player here,
But in a fiction, in a dream of passion,
Could force his soul so to his own conceit
That, from her working, all his visage wann'd;
Tears in his eyes, distraction in 's aspect,
A broken voice, and his whole function suiting
With forms to his conceit? And all for nothing!"

Hamlet, act ii., sc. 2.

"We have seen that the study of the theory of expression confirms to a certain limited extent that man is derived from some lower animal form." To this statement of Mr. Darwin's we demur; for, as far as we can discover, all that is common to man and to the lower animals as regards expression (except in some very slight degree in apes) is that both man and the other animals make signs and gestures and utter sounds to express their emotions; but each uses signs, gestures, and sounds which are markedly different and distinctive. Mr. Darwin further remarks: This supports the belief of the specific or sub-specific unity of the several races; but, as far as my judgment serves, such confirmation was hardly needed. We have also seen that expression in itself—or the language of the emotions, as it has sometimes been called—is certainly of importance for the welfare of mankind. To understand, as far as is possible, the source or origin of the various expressions which may be hourly seen on the faces of the men around us, not to mention our domesticated animals, ought to possess much interest for us. From these several causes we may conclude that the philosophy of our subject has well deserved the attention which it has already received from several excellent observers, and that it deserves still further attention, especially from any able physiologist.

Elementary Treatise on Natural Philosophy.—By A. PRIVAT DESCHANEL. Translated and edited, with extensive additions, by J D. EVERETT, M.A., D.C.L., F.R.S.E., Professor of Natural Philosophy in the Queen's College, Belfast. In four parts. Part IV.: Sound and Light. Illustrated by 187 engravings on wood, and one coloured plate. London: Blackie and Sons, Paternoster Buildings, E.C. 1872.

THE present is the concluding part of this very valuable work, and we find it quite equal in its high-class character, succinct, yet explicit style of description, and elucidatory engravings, to any of the former parts. It may be fairly stated that this work of Deschanel, in the shape it is presented to us by Professor Everett, is a complete compendium of science, so explanatory and well illustrated that any person of ordinary education can by studying its pages make himself acquainted with all the material points of the varied branches of natural philosophy. This is saying a great deal, but we consider we are fully justified in saying it.

Carr's Patent Disintegrating Flour Mill. also Carr's Patent Process of Flour Making on a Novel System or Mode of Manufacture. Bristol: T. Carr, Richmond Road, Montpelier; Edinburgh: J. & J. Cunningham, 102, West Bow.

CARR'S disintegrators bid fair, as it appears, to replace the old millstones used in the manufacture of flour, and revolutionise one of our most important industries, perhaps the most important of all. Hence the statements in this pamphlet are worthy of most serious attention, and therefore we have much pleasure in introducing Mr. Carr to our readers, and will let him tell his own tale.

"By this new system," he says, "material of an unfibrous and friable nature, if of adequate specific gravity, is without grinding, compression, or friction 'shattered into powder by percussion in mid air,' the said percussion being derived from the reiterated free blows of numerous, continuous acting, unarrested beaters, silently rotating in alternately reverse directions with extreme rapidity, and successively dashing to and fro each individual particle, while unsupported it is being dispersed with projectile impetus by centrifugal force, and isolated in its flight from contact with everything but that of each whirling beater encountering and shattering it by collision in mid-air. Thus, the gravity and impetus of the material operated on serves as the sole abutment to the machine, in contradistinction to the system hitherto invariably pursued, of reducing all materials between two working surfaces, one of which surfaces supports them and acts as an abutment to the other while operating on the said intervening materials. All mills in the world of every description and for all purposes are, without a single exception, based on one or the other of the above two distinct systems. For minute operations, or for fibrous or extremely light materials, or for such as require reducing to an absolutely impalpable powder without sieving, the old system must still prevail; but for the wholesale reduction of an immense variety of other articles to a fine granular powder, the new one is now universally admitted to be incomparably the best.

"It has been found pre-eminently successful when so operating on either hard or pasty materials of considerable specific gravity, such as ores, minerals, clays, and manures, for which it was originally intended, yet though so far as the invention had been hitherto developed, its machines could be constructed to roughly pulverise very readily the millstones themselves, or any of the numerous articles, and such as are *ejusdem generis* to those enumerated in my previous patents and circulars, yet all of these machines, though made wholesale throughout Europe and America, were hitherto utterly unsuited to and totally incapable of reducing to fine flour so light a material as wheat. Happily, however, the novel combination of principles, mode of action, and system of disintegrating matter, which I had discovered and inaugurated in my invention of the original disintegrator, are of so unusually versatile and expansive a nature as to have recently enabled me to extend their original sphere of usefulness, and to adapt and apply them, without any pernicious complications, to the purposes of a flour-mill, a matter of incalculably more importance and value than those for which it had been originally designed, patented, and used. One also of a peculiarly special and exceptional a character, not merely from the vast difference to those hitherto operated on, in the nature and required treatment of a compound material such as wheat is, in which one portion has to be finely powdered and the other (the bran) as little so as possible, but more especially so when the said article is considered conjointly with the peculiar mode of action of this unique mill. For, as above stated, it is entirely destitute in itself of anything to serve as an abutment, which is invariably provided in every other kind of mill, and is therefore wholly dependent, as aforesaid, for that indispensable adjunct whereby alone it can operate at all, on the gravity and impetus of the material itself that it pulverises, the said material for the time being constituting as it were a vital portion of the machine itself and an active agent in effecting its own disintegration. It appeared therefore to all familiar with the *modus operandi* of this machine directly contrary to its principles, as long since correctly defined and published far and wide by myself and subsequently by others, and equally adverse also to the experience derived from the daily working for many years of hundreds of the original disintegrators, for it to be imagined for a moment that wheat, with its low specific gravity, smallness of its particles, and the tough and fibrous nature of its outer covering, the bran, could by its mere *vis inertiæ* present sufficient resistance to the beaters to enable them to reduce it into flour while it was unsupported and flying freely through the air. If, however, by any device such a thing were ever devised at all, it was considered irrational in the extreme to imagine that flour so produced could be fit for anything but the coarsest brown flour, owing to the fine pulverising of the bran, which it was erroneously supposed would in such case be inevitable. My proposed attempt therefore to construct a flour-mill on the basis of my disintegrator was satirised as a hallucination in the scientific journals of America and regarded as wholly impracticable by all who heard of my intentions here.

"In fact it was one of those prospective projects the entire success of which in practice can by no possibility be proved or demonstrated from theory; and in the absence of all tangible evidence or precedents but such as appear adverse, the public instinctively regard all such untried propositions, involving sweeping innovations on long established usages, as chimerical illusions, while they are necessarily more or less hypothetical even to their projectors themselves, having no actual existence as real inventions until they have assumed a material form and by the test of practical operation their entire success has been thereby proved to be an accomplished fact and an established reality, superior to all preceding contrivances for kindred purposes, and of substantial benefit to the community at large. Now, happily in this case all these requisites have at length been most satisfactorily accomplished, in which practice has more than realised the dubious hopes of theory, and for ever removed obstacles hitherto thought insurmountable. The grand result of which has been no less a matter than the metamorphosing of my granulating ore, mineral, clay, and manure mill into a novel flour mill, of such marvellous efficiency as greatly to surpass in quality, and by full thirty-fold in quantity, the work a pair of millstones will do, while it simultaneously introduces an entire new process of flour-making of unparalleled efficacy."

The Civil Service Arithmetic.—By R. JOHNSTON, Author of "The Competitive Geography," &c. New edition, with examination papers given at the open competitions, &c., &c. London: Longmans, Green, and Co. 1872.

WE welcome with pleasure this new edition of a thoroughly practical work, which is worthy of our hearty commendation.

Hints and Facts on the Origin, Condition, and Destiny of Man.—By PIUS MELIA, D.D. Second Edition. Revised and improved by the Author. Burns, Oates, and Co., Portman Street and Paternoster Row.

On Mankind, their Origin and Destiny.—By an M.A. of Balliol College, Oxford. London: Longmans, Green, and Co. 1872.

WE are pleased to find that Dr. Melia's very commendable work, reviewed in our April number, has reached a second edition, and that the Doctor has been induced to revise and improve his book. Not that there was much need for any revision or improvement, for the professed object of the work being to proffer hints and facts for attentive consideration, and not to present the public with an exhaustive treatise, the work as it originally stood was, as we formerly stated, a good fulfilment of that task.

The new edition of this work is the more welcome to us just now because, from its being designed to support the orthodox view of the question, it enables us to have before us at the same time the *pro* and the *con*, since the work by the M.A. of Balliol is by no means of orthodox character; as, whilst Dr. Melia's hints and facts tend to support the two principal propositions that there is "an intelligent first Being, the principle and ruler of everything," who is distinct from the material universe, and that there is a supernatural revelation given to mankind by their Creator, the M.A. of Balliol denies or disputes the truth of these propositions in a book which we are bound to say is no mere skim-the-surface production, but a work of deep erudition and learned research, such as might be expected from an Oxonian of high standing.

The work is, however, little to our taste, for it deals not so much with scientific facts as with old world literature and old world traditions. In tone and *animus* it is antagonistic to the Bible as an authoritative revelation from God—nay more, the sentiments and views likely to be gathered up from the perusal of its pages are that the God of the Scriptures is a mythical Being, and that universal Nature is the only God, as will be seen by the perusal

of the following extract from the concluding pages of the work:—

"All is eternal in Nature except the modification which matter undergoes by changes of form. Goethe says of her, 'She is at once the supreme unity and infinite variety—what she does now she will do for ever. She shows herself to each individual under different aspects, she hides herself under thousands of names and terms, and yet she ever remains the same.' From her we sprang and to her we must return, but the very fact that, finite beings as we are, we can aspire to the infinite is a proof that we are immortal. We are sure that that glorious and ennobling hope cannot have been implanted in us in vain, whatever may be the way in which it is to be realised."

A very large portion of the work is devoted to a critical examination of the authenticity of the Sacred Writings, and their claims to infallibility as divinely inspired works.

The majority of the human race are imbued with the notion that the world and they themselves were specially originated and are kept in vital action by the operations of a supreme intelligent Power, so manifested to mankind that the attributes of such Power are placed on record for their benefit. Hence, to make known the erroneousness of the views of those persons who uphold the *ultra* notions generally accepted by religionists as to the nature and extent of the revelation from God contained in writings which are held to be divinely inspired, or written by special divine direction, does not strike us as a sufficient argument against the authority of such writings taken as a whole. Nor does it destroy the validity of the high claims of such writings to show us that in many portions of them the rules of interpretation should be entirely different to those applied to ordinary works.

Our M.A. of Balliol states nothing new when he explains that Origen, Clement, Alexandrinus, and others were in favour of a very different kind of explication of the Holy Scriptures to that which the Rev. Boanerges Poundtext and his class adopt in order to keep up their character as preachers of sound doctrine.

Without for one moment endorsing the author's opinions and conclusions we must frankly admit that Bibliolatry is smitten hip and thigh; and could those persons who believe in it be brought to fairly weigh and consider the criticisms placed before the public in this work, the true position of the Holy Scriptures as historical, dogmatic, and scientific works would be arrived at, and notions higher, nobler, truer, and more catholic (in the true sense of the term) would take possession of their minds, to the great gain of religious progress. But we fear that class of people will turn from this book with horror; hence we do not think it worth while to examine into it with any regard for their principles and views. Moreover, by any such statements he by no means proves what he evidently intended to prove, namely, that there is so much uncertainty as to what the Scriptures really mean that we ought to look upon them as containing narratives and statements as mythical as the works of Homer or Virgil.

It may be true that our canonical books are very unreliable as scientific history of the origin of the world, or even of the advent of man, and yet it may be thoroughly true that they contain the revelation from God to man as regards man's moral and religious status and final destiny.

Much use is made of the evident similarity of the ideas promulgated in the Scriptures with those embodied in religious systems more ancient than Judaism and Christianity, and the author hence concludes that the latter are borrowed from the more ancient religions which preceded them.

To our mind this similarity merely proves that Biblical and Christian religion embodies universal truths which have been acknowledged by many persons who did not believe in the Bible or in Christ. Thus, although we acknowledge the merit of this work, we do not agree with its conclusions, and cannot regard it as a veritable solution of the problem it professes to deal with.

The Telegraphic Journal, and Monthly Illustrated Review of Electrical Science.—Edited by the Rev. WILLIAM HIGGS, M.A. No. 1, for November, 1872.

THIS is a new serial, devoted to electrical science, and appears to be well worthy of the support of all electricians.

We have received the last volume of *Cassell's Technical Educator.* We postpone our review of the entire series till next month.

Proceedings of Societies.

AERONAUTICAL SOCIETY OF GREAT BRITAIN.

SIXTH ANNUAL REPORT.

A GENERAL meeting of the members of this Society was held in the Theatre of the Society of Arts, on Monday evening, the 17th July, for the reading and discussion of papers. The chair was taken at 8 p.m., by Mr. James Glaisher, F.R.S., and there was a considerable attendance of members.

Mr. Fred. W. Brearey, the honorary secretary, read the minutes of the previous meeting, which were duly confirmed.

The Chairman then rose, and said that he could not but regret that some of the vice-presidents were not present; and it was also a matter for regret that he should not have to speak of much work done since last year; but that was not much to be wondered at when they considered the nature of the problem to be solved, and the busy occupations of the men who had to solve it. Still, they met this year under favourable circumstances. Since their last meeting the siege of Paris had set men's minds at work on the subject of aërial locomotion. The only means of getting out of Paris were by balloons, which had been so useful to all who were engaged in this branch of science. But great minds had been brought to bear upon the subject of aërial navigation, and experiments were being continued, so that a great deal might yet be done to increase human knowledge in this respect. If even they did not succeed in the solution of the problem they were seeking to solve, they would still be doing some good by adding to existing information on the pressure of wind upon a roof or upon a shaft. For this purpose the Society itself, through Mr. Wenham, had directed a machine to be constructed by Mr Browning, who, he was sure, would take great interest in the work, and would give to it all the time and attention required. Admitting that their progress had not been great, he considered that from the number of great minds now engaged in helping them some advantages were being gained, and he had no doubt that this would be further increased. (Cheers.)

Extracts from a letter to J. Browning, Esq., F.R.A.S., by Richard A. Proctor, Esq., B.A., F.R.A.S., containing suggestions on the resistance of planes caused to traverse the air, was then read.

The next paper, contributed by Mr. A. Alexander, M.A., C.E., and read by the honorary secretary, entitled "Aërial Flight, as dependent on Man's Muscular Exertion," was as follows:—

Very few of the methods which have been proposed from time to time for accomplishing aërial navigation have been submitted to anything resembling even a remote approach to practical tests; and hence, in the mind of each projector, there is a tendency to assume for his scheme a measure of success, even in cases where this idea would be effectually dispelled by an actual trial.

If we put the balloon out of consideration, the different proposals made from time to time may be divided into two distinct classes —viz. (1), those in which the power necessary for flight is supplied by an engine actuated by steam, gas, or other similar agency; and (2) those in which the power is to proceed from the muscular exertion only of the flyer. In the first class it is assumed that man's muscular power will be insufficient to support flight beyond more than, at the best, a very short distance; and, in the latter class of plans, this power is obviously considered by those who approve them as adequate for flight of such duration as to be practically useful.

While the writer of these remarks must rank himself decidedly with the supporters of the former class, yet he is fully aware of the importance of avoiding any dogmatic views in a matter of which we as yet know so little; and he has, therefore, availed himself of some opportunities to examine various schemes for flight by muscular power, with the view of ascertaining their merits or defects.

Now the detection and precise statement of any weak point in the reasoning by which a peculiarity of construction is defended certainly comes next in importance to the suggestion of methods for actually accomplishing the end in view. By thus, as it were, clearing the ground, our time and means are not taken up as they might otherwise be in labours which will yield no satisfactory result. It is, therefore, thought to be desirable to point out to the members of the Society what is considered to be a fallacious mode of considering the action of certain apparatus for achieving flight.

The writer has been led to this by his examination at the request of our secretary (Mr. F. W. Brearey) of the plan and arguments brought forward by Mr. Craddock (whose ingenuity and valuable suggestions in other fields of mechanical inquiry seem often to have been appropriated without acknowledgment) for accomplishing flight by muscular exertion simply. Mr. Craddock had patented his plans in 1867 (No. 1082), but the drawings more recently prepared showed a considerable improvement on the patented design.

It must be noted, however, that these remarks do not refer to any special apparatus, but exclusively to a special argument or point of view by and from which such apparatus are justified and their practical utility asserted. The reasoning by which the sufficiency of such apparatus was supported is as follows:—

Suppose an upright metal rack resting on the ground, and gearing into it is a pinion, which is on the same centre or spindle as the wheel. This wheel is provided with steps round its circumference. The pinion being supposed to be kept in its place, and prevented from falling back out of gear by suitable guides, it is obvious that were a man to place himself on the steps of the wheel he would, by its rotation, elevate himself to any desired height. The apparatus, in fact, constitutes an ascending treadmill, and there can be no doubt that, with a break provided upon the upright guides to regulate the speed, a man might mount in this way without difficulty.

"Now, here," says the advocate of the muscular system, "the man's force is, *with a suitable mechanism*, perfectly competent to raise itself to any given height; and that the air may take the place of the rack in this arrangement it is only necessary that the *leverage be adjusted* to that end. It is a mere question of leverage; for we know that an extended surface, if moved with sufficient velocity, will sustain a reaction equivalent to the weight of the man. Let the leverage then be adjusted, but in the inverse direction; so that this velocity may be obtained from the man's motion, and he must *rise* just as he does when supported on the metallic staircase."

This mode of considering the matter is plausible, but it involves, I think, the fallacy of assuming the very point which is in doubt. It appears so evident that if a surface or surfaces be moved with sufficient rapidity they will counterpoise the weight to be raised; and then, this being allowed, that a man will

be able to raise himself on the rack-like support thus afforded, that one is apt to consider the rack as a *fait accompli*, in which case we can hardly avoid the conclusion that by its aid we may ascend to any desired altitude. But the fallacy here consists in assuming at all, without proof, the existence of the aerial rack, or rather in assuming that a man's force is competent so to move surfaces that an effective and effectual reaction may be obtained from them. With the form of illustration above explained, the mind is apt to dwell on the fact that the muscular power is thus shown to be sufficient, by appropriate mechanism, to raise the body, while it assumes that, as the intervention of mechanism involves no loss of power apart from friction, the conversion of the slow into the quicker motion required is a mere matter of mechanical detail. But it must not be forgotten that the muscular power has to effect two objects — first, to produce such motion in surfaces sufficiently extended that the weight of the body shall be counterbalanced; and, secondly, to elevate the weight of the body upon the aerial rack thus produced. The first part of the business is precisely that which it is assumed has been done by drawing the rack on paper, but it is that which in fact constitutes the sole difficulty, and the possibility of which is denied by many.

Supposing it to be effected, we can easily see that the *ascent* of the rack, or the actual elevation, would require the most trifling addition to the force already supplied; for if a certain mass be in perfect equilibrium in space, a very small force will, if sufficient time be given, generate any velocity required, the resistance of the atmosphere being excluded. Taking this resistance into account, it would still be true that a very small force, continuously applied, would suffice to generate a high terminal velocity. Returning to the rack illustration: if the radius of the path on which the man travels were to coincide with the radius of the toothed-wheel, then evidently (apart from the weight of the apparatus) the man would be in perfect equilibrium, but a very small increase of the radius would suffice to produce an upward movement and relatively downward movement of the revolving platform so great that a man's speed would be unable to keep up with it. No just inference can, therefore, be drawn from reasoning founded upon the case with which muscular exertion would enable us to rise by means of such a revolving platform as that which has been described, for to assume the possibility of any reaction from the air due to the muscular force expended and akin to that afforded by this platform is to assume the very point at issue. The writer, while far from wishing to discourage inquiry on the part of those who may think otherwise, has long been of opinion that man's muscular exertion will be found, in all cases, quite inadequate to maintain any such reaction for more than the shortest space of time, and that to accomplish aerial navigation in a comprehensive sense we must obtain a proportion of power in relation to weight considerably greater than we at present possess.

Mr. A Stewart Harrison remarked that a pigeon weighing 1lb lost as much as 2oz. in weight by flying 500 miles, and that a man lost 5, 6, 7, or 8lbs. in doing a certain amount of work, and he believed there was an analogy between the two. He suggested that some eminent physiologist should inquire into the subject, and determine the relative proportion of muscle force between the bird and man. Man simply required special mechanical appliances to supply him with the power which birds possessed naturally.

Mr. Moy feared it would be hopeless to attempt to make any model fly without the aid of an intelligent muscular guidance.

Mr. Sparrow considered a man would have the strength to fly if he had the proper muscular development. He was at that moment engaged in the preparation of an experiment founded on this theory, and he hoped shortly to be able to give the members of the Society the results of a trial with the machine.

The Chairman asked Mr. Harrison if it was really an established fact that a pigeon lost 2oz. of its weight in flying 500 miles.

Mr Harrison said he had no personal knowledge of the truth of the statement.

The Chairman—observing that, if true, the circumstance was extraordinary—said he had never heard of so great a loss of muscular power.

The discussion closed, and Mr. Alexander received the cordial thanks of the meeting.

Mr. Wenham then read a paper on "Particulars of Experiments made January, 1846, to ascertain the law of resistance to the passage of Air through pipes of different diameters and lengths at various velocities," by J. Spiller, M. Inst. C.E.

Mr. C. A. Bowdler next read a paper entitled "Aërial Navigation," which he illustrated by a working model. In this paper he said:—

Before describing the model of a machine I propose for the purpose of deflecting balloons from their wind course, I wish to draw your attention to the principles that govern aërial navigation; not to offer anything new in that respect, but to show that they admit of the possibility of applying machinery to control, to a limited extent, the course of balloons, and thereby make them useful.

The ascending power depends chiefly on the density of the gas employed. Hydrogen gas, the lightest known, is expensive, and difficult to obtain in sufficiently large quantities for general balloon purposes, and ordinary coal-gas is comparatively heavy, having a density of ·50 to ·60; but by employing a high temperature in the distillation a much larger quantity and lighter quality can be produced; thereby giving balloons of moderate size sufficient buoyant power to carry up considerable weight.

The vertical motion of a balloon is under the control of an experienced aeronaut, but the horizontal motion entirely depends on the currents of the air, notwithstanding the many contrivances that have been tried, none have satisfactorily enabled the aeronaut to guide the balloon out of its wind course.

According to the well-known tables of Smeaton and Dr. Hutton (which I believe are sufficiently correct for any practical purpose), air moving with a velocity of two miles per hour has a force of 0·01971bs. per foot on a flat surface, and this force increases as the square of the velocity, but spheres (such as a balloon) offer less resistance than flat surfaces by one-half.

A balloon moving with the wind meets with no resistance, and therefore moves in the same direction; if, however, a second force be exerted on the balloon in a different direction to the wind, its course will then be in proportion to the two forces.

A balloon of 40ft. diameter, moving at 10 miles per hour, requires a force or pressure of about 310lbs. to destroy its motion, this will represent the force of the wind. The force required to move it 4 miles per hour is only 50lbs., or ⅙th force by which the balloon is carried 10 miles per hour.

This force of 50lbs. (and more) can be produced by the machine I propose. It consists of a spiral fan made to revolve with great velocity, the axis of the fan to be kept at right angles to the direction of the wind by means of a rudder fan, which causes the balloon to turn on its axis as required; the revolving fan producing a pressure on the air, and forcing the balloon in the direction of its axis.

My model fan is 16 inches in diameter, and gives a force of 1⅓lbs.; one three times the size will give a force of 120lbs.; thus 3 times the diameter equal 9 times the area, and 3 times the velocity equal 9 times the force; therefore, $9 \times 9 = 81$; $81 \times 1\frac{1}{2}$lbs. $= 120$lbs.; this force is sufficient to deflect a balloon 5 miles per hour in any direction.

The fan is protected by a covering or drum and is fixed above the car, and made to revolve by means of a windlass fixed in the car; and I believe four men have sufficient power to work the windlass and produce the force stated.

[Since reading the above paper the author has made some improvements, and is now, with the assistance of Mr. Coxwell, making practical experiments. The rudder-fan is superseded by vertical discs fixed at each end of the fan axle.—Ed. of the Report.]

Mr. Browning considered they must learn something from experiments such as those treated of in the paper.

The Chairman observed that although mathematical science connected pressure with velocity, no proof of such had as yet been afforded by practical experience.

Mr R. C. Jay read a paper descriptive of "A Model of Wing Propeller," constructed by him. Its action was exhibited. He said:—

The model exhibited by me at the last meeting of the "Aeronautical Society of Great Britain," the principal parts of which are shown in the annexed plan, was constructed in order to illustrate a method by which wings of any length or weight may be used, without loss of power by raising the weight of the wings before each downward stroke. The action of the wings may be regulated by the angle at which they are set, so as to give a forward and upward pressure; but I propose using them only for a forward pressure both in the up and down stroke, as I consider it to be impossible for mechanical flight to be accomplished with safety by the aid of wings alone, and the ascending power must be derived from the action of the air on an inclined plane entirely independent of the wings.

The propeller consists of two pairs of wings which balance each other, and, being connected by an oscillating beam, the one pair ascends as the other descends, and the whole of the force exerted is utilised by pressure on the air, with the exception of a small portion absorbed by friction. The effect is that of an inclined plane pressing on the air, and acting on a fresh column at each stroke, whether up or down, but if the machine is retained in one position, so that the wings may act on the same column of air, although there is no power to rise perpendicularly, yet the forward pressure will be materially increased during the first few strokes, as the downward stroke will draw a column of air after it which will be met by the wing in its return, producing an upward current, which will be again met by the downward stroke. The propelling force to be obtained in this manner is very great, and with wings of considerable length a very slow movement will be found sufficient to obtain the necessary speed. The real motive force of an aerial machine is, I consider, to be found in its own weight; and the duty the propeller has to perform is to neutralise the resistance of the air, which would not be great if the various parts of the machine were so arranged as to oppose the least possible surface to forward motion. Steam power may, in my opinion, be successfully applied to aerial navigation, as the weight can be brought within the right proportion to surface and power, and I think it is the most suitable, as a fresh supply of fuel and water may always be obtained without difficulty.

A paper by Mr. H. M. Sykes, of Cleckheaton, was taken as read, entitled "Thoughts upon the Present Position of Aëronautical Science."

A communication addressed to the Honorary Secretary, from J. Bell Pettigrew, M.D., F.R.S., of Edinburgh, on a "New Form of Propeller for Water and Air," was then read.

"The Mechanism of Flight in the Animal Kingdom," by Dr. Marey, translated from "L'Aëronaute," by T. J. Bennett, Esq., was also read.

(Continued on page 182.)

The Scientific Review

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THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON.

[illegible] MAY, 1862.

[illegible]:

SIR [illegible] BREWSTER, K.[illegible], LL.D., F.R.S., &c., from the establishment of the INVENTORS' [illegible], till his decease, February, 1868.

LORD [illegible] GROSVENOR [illegible].

Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES

THURSDAY, 5TH DEC. On "Trade Guilds as Promoters of Invention and Technical Education." By F. W. C[illegible], Barrister-at-Law, Member of the Council of the Institute.

THURSDAY, 19TH DEC.—Meeting [illegible] Patent Law Reform.

Members [illegible] subscriptions are now due will please to forward the same to the Collector [illegible], 4, St. Martin's Place, Trafalgar Square, London.

Monthly Notices.

The Bessemer Anti Sea-sickness Ship.—The Hippopotamus.—Captain Dicey and Mr. Mackie's [illegible].—Occupations for Leisure Times.—The Little Dressmaker

DURING the past month the two great topics of the day have been the anti-sea-sickness vessel of Mr. H. Bessemer, and the birth of a hippopotamus at the Zoological Gardens. With regard to the latter some important remarks will be found in the Report of the Zoological Society; and with reference to the former, it may be briefly stated that Mr. Bessemer's invention consists in the adoption of hydraulic arrangements underneath the floor of a saloon in the ship, such apparatus being so arranged that as the vessel rolls to either side the pressure or resistance of rams is brought into play and utilised for checking the motion. By means of a small horizontal lever a steersman can set the apparatus in action so as to rectify, by reference to a curved spirit-level placed before him, any rolling motion. For meeting the pitching, Mr. Bessemer places the saloon in the middle of the ship and increases the length of the vessel. The principle of the saloon, in fact, is to be carried out in a steam-ship which has been specially designed by Mr. E. J. Reed, C.B., for the Channel passage. This vessel will be 350 ft. long, with 45 ft. deck-beam and 65 ft. over her paddle-boxes, and which, when fully loaded, will draw but 7 ft. 6 in. of water, thus enabling her to meet the requirements of the present shallow harbourage on either side of the channel. The saloon will be placed in the centre of the vessel, a position now generally occupied by the engines, which will be placed fore and aft the saloon, and will drive two pairs of paddle-wheels, as the small draught of the vessel will not admit of the use of a screw. She will be propelled by engines of 750-horse power nominal, indicating up to 4600-horse power, and is expected to attain a speed of twenty miles an hour. The vessel will be double-ended, so as to enable her to enter and quit existing harbours, and at each end will be a well-appointed cabin for second-class passengers. Each extremity of the ship will have a very low freeboard, so as to cut through the waves instead of rising to them. This, combined with the great length, peculiar shape, and the distribution of the weights carried, will tend largely to get rid of the pitching motion, so as to be scarcely appreciable in a saloon situated midway of the length of the vessel. To demonstrate the feasibility of his scheme, Mr. Bessemer has constructed a large working model in the grounds of his residence, which is larger than the midship section of one of the "Citizen" steam-boats. It is understood that one or more vessels thus fitted will be shortly built under the direction of Mr. E. J. Reed, and the principle actually put in practice in the Channel.

In this pleasant work of preventing sea-sickness Mr. Bessemer is not without rivals. Mr. Mackie and Captain Dicey have plans which have, we understand, much in common; Captain Dicey's being an arrangement of two half-ships yoked together, propelled by a kind of turbine propeller. This plan is strongly advocated by Admiral George Elliot.

Want of space prevents our presenting our readers with a column on occupations for leisure hours, though we cannot avoid referring to the entertainment now placed before the public at the Lyceum Theatre, by the representation of the play of "Charles the First," which contains as gross a libel on the character of Cromwell as even a morally-perverted mind could possibly devise. We all know there are two opinions about Cromwell, but it is a gross caricature of his character to present him to the public in the light of a miserable sneak who offered to betray his companions if the King would make him Earl of Essex. It is true the play is well put on the stage and well acted; but we hold that the public should give no encouragement to such flagrant departures from historic truth.

We have received a copy of a technical work which will please all mammas and their daughters. Its title is "The Little Dressmaker." Fashions for children and dolls. Edited by Mme. Marie Schild. It contains a beautiful illustration of the latest fashions for children's and doll's clothing, with the cut paper patterns, &c. Price sixpence monthly. The publisher is S. Miller, 37, Tavistock Street, Covent Garden, W.C.

ECONOMIC TREATMENT OF FLAX.—Amongst the English exhibits at the Moscow Polytechnic Exhibition, just closed, two machines were forwarded by Dr. R. H. Collyer, of London, for the more economic treatment of flax, the chief feature of which is that it is adapted for use with hand labour only, and as it is not liable to get out of order, and requires but little power to run, the opinion was very generally expressed that it would come into very general use throughout the Russian empire. For competitors Dr. Collyer had the well-known firm of Lawson, of Leeds, as well as a Belgian and a Prussian house, yet his success has been most marked. He has just received intimation from his representative in Moscow that two gold medals have been awarded to him—one for each of the machines.

PROCEEDINGS OF SOCIETIES.

(*Continued from page 180.*)

A communication from Mr. David E. Gostling, C E., Bombay, was also read, which, in addition to much interesting information, stated that a machine for flying could be made as follows:—

There should be a framework of bamboos, or other light and flexible material, to which should be attached wings made after the model of a bat's wing, of "bamboo—main pole and branched twigs," covered with canvas: the man, standing upright on the bottom of the frame, should grasp the handles of the wings, and pull and re-pull vertically, using the same action with the hands and feet as if he were rowing in a boat. The difficulties to be got over are—1st, the feeling of utter insecurity in standing, as it were, on a slack rope, pole in hand; 2nd, that each pull must be of such force as would be at least sufficient to lift the body entirely off the ground. The first difficulty can be got over by practising with the following model — Let two poles be set up, about 8 feet apart; tie to each, about 5 feet from the ground, the ends of two levers, each 4 feet 3 inches long, so that the other ends of the levers shall meet as with a pair of sculls in rowing; get a board, about 2 feet by 5 feet, suspended by four ropes or iron rods to the levers Then, standing on the board, grasp the depressed levers, and pull them up as in rowing; one will be thus lifted off the ground, with the moral certainty of being, for many attempts, thrown violently down again. By practice a balance with perfect steadiness is obtained, and the whole weight of the body can be lifted without trouble. When the board is hung to the centre of the lever, a force equal to one's whole weight must be used in lifting. When hung one-third length from the fulcra, a force equal to half one's weight is necessary. In this model (necessarily imperfect) the points of attachment of board to levers represent that portion of the frame to which the wings would be attached, and by which the frame would be upheld at each stroke, the fulcra of the model are an imperfect representation of the central point of the resultant action of the wings on the air, and by which the whole frame is upborne. By continuous practice a light, short, and strong man could so balance himself, and so develope the requisite muscles, as to make air navigation feasible as soon as the machine is designed fit to carry him. Reasoning by analogy, the wings should be of larger proportionate size to the man's bulk than the vulture's wing bears to its bulk, and the man will pull at longer intervals than does the vulture, *i.e.*, at something near the rate of slow rowing. The bat's wing being taken as the model, the wing could be made with one long bamboo as the primary limb, the young bamboo shoots being straightened so as to be perpendicular to it, forming the secondary limbs, and calico stretched over all. The whole frame and wings should not weigh more than 20lbs.

All this may appear chimerical to many, but it rests on a solid basis of truth. The action of the wings pressing down the air really forms a solid fulcrum upon which the body of the bird is upborne, and its action in the case of a man would be the same. If he can lift his own weight and more again and again off the ground, by a series of measured strains similar to rowing, as is shown in the accompanying sketch, this same power, properly directed and applied, will enable him to sustain and impel himself forward in the air. Large birds, once above the ground, have no difficulty in keeping themselves up with but slight exertion, as the bearing area of their wings is so large; by analogy, this is in favour of the man, who would use wings very large in proportion, while the capability of continued resting would make possible ever new and continued exertion.

The Report contains the following concluding remarks, which are worthy of the attention of all inventors who have a fancy for aëronautics:—

The advocates for balloon propulsion will accept no discouragement.

At the least two-thirds of the designs submitted to the Society have for their object the propulsion and guidance of balloons. The siege of Paris has increased the number of enthusiasts in this direction. The adoption of mechanical means to effect such extreme measures as may become necessary upon contingencies similar to those which urgently called for the employment of balloons in Paris is perfectly legitimate, and will, no doubt, for a long period exercise the ability of inventors. In such cases a very small point gained at a vast expense may become a great advantage; and as to cost, such a consideration scarcely exists in time of war. The work which this Society aims at accomplishing embraces general utility, and it need scarcely be reiterated that for this purpose balloon propulsion is a fallacy, shown by the great number of unsuccessful attempts that have already been made, which have failed for reasons that have been repeatedly discussed by our members.

It is almost beyond a doubt that the persistent efforts to effect this otherwise much-to-be-desired problem has had a retarding effect upon the increased utility of the balloon.

The balloon is understood, in connection with this remark, to be the usual enclosed bulk of light gas, with its pendent car.

It has been pointed out in a paper read by Mr. F. W. Brearey, at Stafford House, February, 1860, published by the Aeronautical Society, that even with its present shape and capability this machine may be made the instrument of much pleasure and service.

If but a small portion of the ingenuity which aims at propulsion; if even a tenth of the power deemed necessary to effect a slight divergence from the course of the wind, were used to effect the ascent and descent at will of a balloon in equilibrium, the balloon itself might be diminished in size, for the twofold reason that no ballast would be necessary, and no superabundance of gas required A few turns of a vertical screw would elevate the whole, and bring it under the influence of the wind. Except to escape trees and buildings, it is scarcely necessary to travel much above the grass. As a boatman with the tide would keep his punt from the shore with a pole, even with the same simple means could the aeronaut keep his balloon from contact with the earth. The extreme sensitiveness of a balloon in equilibrium would probably cause it to respond to a vigorous push, so as to escape a tree or building. The vertical screw, however, being adopted, or two screws superposed, to prevent gyration, the following advantages would accrue.—A great reduction in the cost of the balloon, a proportionate reduction in the cost of inflation; anchorage at any time—resumption of the journey—the possibility of a return to the proximate place of departure. Hitherto the most serious drawback to the use of balloons amongst amateurs for pleasure traffic has consisted in the expense, want of skilled management, and the short-lived character of the venture.

The advantages which would attend the use of the vertical screw in the manner proposed have all been ignored in the more ambitious attempts at propulsion. The A B C of aëronautics has been neglected for the X Y Z.

The Society possesses encouraging data relative to the performance of vertical screws, which, if not suitable for the application of the whole of the power requisite to elevate a non-buoyant apparatus, is eminently favourable to their use for effecting the ascent and descent of balloons, because it must be borne in mind that far greater results would be obtained if the screw took hold of a fresh body of air at each revolution as during its own progress; and it should ever be remembered that in aëronautical contrivances either to obtain propelling or lifting force, neither can be secured whilst the machine remains still and acting upon the same column of air already set in motion. Success must depend upon the impact upon a fresh and unmoved body of air at every impulse or degree of forward progress. This is a condition of long extended flight, and other observations in Nature tend to confirm it, for who has not noticed the behaviour of falling leaves in autumn, all much alike in weight and size? Some fall down straight and quickly; others of a twisted form acquire rotary motion, and descend in a spiral course, and consequently are much longer reaching the ground. Many acquire an oscillating movement, and vibrate from side to side in their descent. These are a very long time in reaching the ground, and are sometimes carried a great distance off by the breeze, for every movement retards the attractive force of gravity, and prolongs the time of descent by the constantly shifting position on a fresh layer of air.

By the aid of a special subscription the Society has been enabled to present to its members some data with respect to the action of a current of air upon inclined planes of necessarily limited area, but varying angles. When the instrument designed for this object by Mr. Wenham was completed, with the aid of Mr. Browning, every facility was afforded for testing its capabilities at Messrs. Penns' Engineering Works at Greenwich.

By means of a fan-blower a current of considerable force was directed through a trunk ten feet long by eighteen inches square. The plane to be acted upon was fixed to the long end of a horizontal arm, which vibrated like the beam of a balance, and bore upon its shorter end a sliding counterweight, so as to balance the weight of any plane which might be fixed at the opposite extremity. The horizontal or direct pressure was read off by a spring steelyard, which was connected to the end of a lever from a vertical spindle close to the base of the machine. The vertical or raising force due to the various inclinations was read off by an upright spring steelyard.

These experiments, when all the angles are averaged for errors, seem to indicate the law that the lifting force of inclined planes, carried horizontally through air, is increased in the direct ratio that the sine bears to the length of the plane, or the height of the incline to the base; thus, if instead of stating the angles in degrees, we say "one in ten," or "one in three or four," as the case may be, this will at once express the proportion in which the lifting force exceeds the resistance. The average of all results is very near to this, making a little allowance for the surface friction of the plane through the air. At 45° the two forces are equal; above this the proportions are in the inverse ratio, as the lifting force is then less than the direct.

It has been stated that the resistance of wedges or cones through the air is diminished directly in the ratio that the height or diameter of the base bears to the length of the cone. The experiments do not confirm this, but show that the resistance is less in proportion as the angle becomes more acute.

It will be seen on reference to these tables that as the angles become more acute the lifting force exceeds the horizontal or power required to propel planes through air in an enormous ratio.

More acute angles than 15° were not experimented upon, but even at this the lift is four times greater than the thrust, and alone serves to abate the mystery relating to the support of weight in flight, which at least in the case of easy-flying birds consists in the action of surfaces at acute angles with the line of motion.

The experiments, though at present somewhat crude and incomplete, show that very oblique incidences or angles, with a small rise, have a remarkably strong lifting force compared with the power required to propel the plane, and that the ratio of the lift to the thrust greatly increases as the angle or rise

diminishes, in all probability accounting for the long-sustained flight of birds with motionless wings. It is desirable that these important experiments should be verified and continued; the apparatus will be at the service of any member desirous of repeating them or trying others. For example, up to the present time only flat surfaces have been experimented upon, and as all the sustaining surfaces in the wings of birds are curved or hollow, it remains to be proved what is the relative advantage of this form, for it is upon such data that all plans of construction must be based, and on which failure or success must depend, and to determine whether flight is practicable or not. The whole endeavour must be to find a support on the air in such a way that it cannot yield, so that there shall be as little mechanical loss as possible from what is known as "slip."

A most evident example of the enormous loss of power arising from "slip" may be cited in the plans that appear, from time to time, for raising men or machinery by means of vertical screws. Taking 200 lbs. as the lightest total weight of the man and machine, the following result will show how utterly inadequate his power is to to raise any but the most trifling weight by such means. Assuming the surface or area of revolution at any number of square feet, the fraction of this weight of 200 lbs. is distributed over each foot of that surface. The force per square foot must therefore represent the wind velocity to produce the reaction or resistance necessary to support the weight. A surface of 25 square feet will then stand thus:—For 200 lbs. there is a resistance of 8 lbs. per foot required. To get this there must be a wind velocity of 3600 ft. per minute, therefore $3600 \times 200 + 33{\cdot}000 = 22$ horse-power.

The theory of the strong lifting power of planes at very oblique incidences, moving rapidly through the air, having now to some extent been practically tested, a few words may not be out of place concerning the position or arrangement of those planes. Mr. Wenham, in a paper read at the first meeting of the Aëronautical Society, brought forward a number of examples in evidence of this great lifting force, but without defining any exact law, merely relying upon it as a fact for the reasons given.

Then came the question how to obtain the large extent of surface in a compass small enough to secure strength with lightness In that essay he showed that an apparatus intended to support a weight of even 200 lbs. on one long extended plane, like the wings of a bird, would be an impracticable construction, requiring long and heavy spars. He then proposed to cut the planes into lengths, and superpose them, like a Venetian blind. It has been objected that this is wrong in theory, and that the action of one plane will interfere with the other; but the fact is that there is no theory in the matter. It is simply a question of construstion. The planes are equally effective in detachments, and may evidently be so arranged as not to interfere with each other. Thus a series of planes made of thin silk or tissue-paper may be rigged, one above the other, like kites on a cord, and weighing not more than half an ounce each, and yet have ample strength to sustain one pound.

Though another season has elapsed, the Society has no announcement to make of the existence of a successful machine for aërial locomotion, or for travelling in any desired direction. Yet the retrospect of the past year shows a decided improvement in the form of experiments made to elucidate and define a correct law of action and propulsion of bodies sustained in air. We have no longer the extravagant and impossible theories of gravity and the laws of motion to account for this difficult phenomenon, so many of which were sent to the Society in the early days of its existence, the publication of which would in no way have contributed to the end in view, but, on the contrary, being wholly unsupported by any practical facts or experiments, would have brought discredit and ridicule upon aëronautics as the science which it may fairly be considered.

Should the problem be solved, the Aëronautical Society will take a high rank amongst its compeers, and cannot now be denounced as useless till flight for man is *proved* to be impossible. There are some amongst not the least earnest of our members who are quite willing to prove its impossibility, calmly regarding it as a mere scientific question; but, in fact, there is more difficulty in proving an impossibility than in constructing a machine having partial or total success, and we are far from being able to demonstrate the certainty of failure by any known laws either of principle or construction. However plausible a mere argument unsupported by facts may appear, we have only to raise our eyes to the machinery of Nature exemplified in large flying birds, and behold a reality yet incompletely explained and not scientifically accounted for.

The Society may congratulate itself for having been the means of bringing together and recording a number of facts not lost upon its members, which have produced greater unanimity of purpose, and have, it is presumed, directed the efforts of experimentalists in accordance with a more generally recognised and practicable theory.

INSTITUTION OF NAVAL ARCHITECTS.

Subjects on which Communications are Desired.—The Council of the Institution of Naval Architects have had under consideration the question of providing a good series of contributions for their next session They have accordingly (with the assistance of a committee specially appointed for the purpose) prepared a list of subjects, which they desire to submit to the Members and Associates of the Institution, and others interested in shipbuilding, as questions on which they will be glad to receive communications for the annual general meeting in April (2nd to 5th), 1873. To prevent disappointment it is requested that all such communications may be forwarded to the Secretary of the Institution not later than the 28th February, 1873; the Council cannot otherwise undertake to find a place for them in their programme of proceedings. It would also be well that gentlemen proposing to read such papers should announce their intention to the Secretary as soon after Christmas as may be, in order that he may be able to make suitable preparations for the meeting. In naming these subjects it is by no means the intention of the Council to restrict gentlemen desirous of reading papers on other matters, nor is it intended that the list should be an exhaustive one.

Subjects for Papers.—1. The construction of vessels for coast defense. 2. The effect on naval construction of torpedoes, or other modes of submarine attack. 3. On the results of the best modern practice in ocean steam navigation, with reference to the latest modern improvements—such as surface condensation, superheating, compound engines, and the like; also the value of each of those taken separately, and especially the results of any actual experiments to test this point. 4. On the friction developed in marine steam-engines of different forms; and on the difference between the *gross* indicated horse-power developed in the cylinder, and the *net* effective horse-power available for the propulsion of the ship after working the air-pump, slide-valves, and other moving parts of the engines. 5. On economy of fuel in marine engines, with detailed results. 6. On marine boilers, their form, rate of combustion, and the proportioning of their various parts. 7. Information as to the deterioration of marine boilers supplied with water from surface condensers, and the remedies for this. 8. Description of any improvements in the *details* of construction of marine engines. 9. On methods for starting, stopping, and reversing marine steam-engines of high power. 10. Details of any experiments tending to throw light upon the theory of the steam-engine. 11. On the life and cost of maintenance of merchant steam-ships. 12. The design and construction of yachts. 13. On legislative interference with the construction, stowage, and equipments of ships. 14. The effect upon shipbuilding of Lloyd's Rules, the Liverpool Rules, and the rules of other similar societies for the classification of ships; and on ships not classed. 15. On methods for the proper strengthening of ships of extreme proportions, and on the precautions necessary to ensure their safety at sea. 16. On the straining effects of engines of high power on the structures of ships, and the arrangements necessary to obviate them. 17. On the present state of knowledge of the strength of materials as applied to shipbuilding, with especial reference to the use of steel. 18. Description of any vessel actually built, or in course of building, exhibiting great novelty in its principles of construction. 19. The preservation of a ship's internal structure from the effects of bilge-water, leakage from cargoes, &c. 20. On the masting and rigging of ships, and on iron and steel masts and yards. 21. On ships' boats, and on apparatus for lowering and disengaging them. 22. On machines for economising labour in the construction of ships. 23. On the use of machinery for economising labour on board ship, whether merchant ships or ships of war, and whether for loading or manœuvring. 24 On the best method of clearing vessels of water in the event of a leak, and on any novel form of ship's pump. 25. On the means of accurately measuring the speed of ships. 26. On instruments for measuring and recording the rolling of ships, both as to time and extent of roll. 27. Actual measurements or records of seawaves; their height, length, periodic time, and speed of advance; or their profiles. 28. On the measure and amount of resistance opposed to a ship's progress by the water through which it moves. 29. Exact information (either experimental or theoretical) on the efficiency of propellers. 30. On the ventilation of ships by natural and forced draughts, with details of any system in actual operation. 31 On the economic value of form and proportion both in merchant vessels and in ships of war. 32. On floating structures for special purposes, such as docks, lighters, tank-vessels, light-ships, telegraph-ships, and others.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

Tuesday, November 5th, 1872.—Dr Birch, F S.A., President, in the chair. The following lady and four gentlemen were duly elected members of the Society —A. St. John Forssmann, Esq, Miss Selima Harris (of Alexandria), Rev. Dr. Rule, J. E Trimlett, Esq., Rev. T. H. Tooke.

The meeting commenced with a sharp and lively discussion upon the Rev. D. Haigh's late paper on Israel in Egypt, in which the xxxii Aahmu in Beni Hassan were identified with the family of Jacob. In the opinion of the Rev. B. H. Cooper, however, the same picture represented the arrival of Abraham and his family into Lower Egypt, while other members again considered the whole as representing the immigration of an Arabian, or even Hykshos Sept. In conclusion great credit was awarded to the learned writer for his very ingenious explanation of a most difficult subject.

The following papers were then read:—

1. "On an Assyrian Prayer and an Assyrian Vision." By Henry Fox Talbot, D.C.L., F.R.S. This was a translation from the Annals of Assurbanipal of a prayer offered by him to the goddess Ishtar just before his Elamite expedition, while another tablet recorded a vision which appeared to one of the royal seers, in which the same deity presented the king with a sacred bow as a pledge of his success over Tiumman, king of Elam. 2. "On the Religious Belief of the Assyrians" (No. 2). By the same. This paper consisted of two sections; the first comprising additional proofs

of the doctrine of the immortality of the soul, and concluding with an Accadian psalm descriptive of the death of a righteous man, ending thus: "Like pure silver may his figure shine, like brass may it be radiant. To the sun, greatest of the gods, may it return, and may the sun, greatest of the gods, receive the saved soul into his holy hands." In the second part of the paper a peculiarly holy object called the *Mamit*, a kind of mystical Palladium, was described, and it was shown that such was its sanctity that, at whatever cost, the holy object must be preserved. This was especially illustrated by the translation of a very beautiful Assyrian choral hymn, the burden of each verse of which was—

"If the temple were on fire
Care not to save the sacrificial victims
Nor the precious vestments of God and the King
In that day, let the fire burn on
But save the MAMIT! place it in safety."

In addition to this proof of its value oaths by the *Mamit* were also given, together with a short psalm or ode, in which this same mysterious treasure was the sole object of veneration. A series of exegetical and mythological notes terminated the paper, which produced an animated discussion. 3. "A T-conjugation, such as exists in Assyrian, shown to be a character of Shemite speech by its vestiges found in the Hebrew, Phœnician, Aramaic, and Arabic languages." By Richard Cull, Esq., F.S.A. The author briefly explained the nature of the T-conjugations of the verb in Assyrian as secondary to the primary conjugations by the insertion of T, either between the first and second radicals, or immediately before the first radicals He then cited certain forms in which a T appears in the same situations in the Hebrew, Phœnician, Aramaic, and Arabic languages. Some of these T forms appeared to the author, as they must have appeared to other Hebrew scholars, as anomalous forms, and it was not until the forms of the Assyrian verb became known that these Hebrew anomalous forms could be identified as vestiges of conjugations in those languages, which existed as a strong feature in the Assyrian and Babylonian from Tiglath Pileser to Darius.

On TUESDAY, 3rd December, 1872, at 8.30 p.m., the following paper will be read: "On a Cuneiform Inscription containing the Chaldean Account of the Deluge," by Geo. Smith, Esq. Sir Henry Rawlinson will take the chair and deliver an address upon this occasion. The following gentlemen will be balloted for:—Sir William Tite, C.B., M.P., F.R.S., F.R.I.B.A., Lowndes Square; M. le Baron de Cosson, Indre et Loire; W. H. Morris, Esq., Brentford.

ZOOLOGICAL SOCIETY OF LONDON.

NOVEMBER 5th, 1872.—Viscount Walden, President, in the chair. The Secretary read a report on the additions that had been made to the Society's Menagerie during the months of June, July, August, and September, 1872, and called particular attention to the Sumatran rhinoceros, purchased August 2nd, but since unfortunately deceased, being the only specimen of this rare animal ever brought to England. The birth of a young hippopotamus which had taken place in the Society's Gardens that day at 7 a.m. was also announced. A letter from Mr. Gerard Krefft, C.M.Z.S., was read, in which he pointed out the differences observed in the species of wombats known to him. These remarks were illustrated by a series of photographs of the skulls and skeletons of this group in the Australian Museum, Sydney. An extract was read from a letter addressed to the Secretary by Mr. Walter J. Scott, C.M.Z.S., concerning the existence of a so-called "native tiger" in Queensland. Mr. Scott stated that an animal, larger than a pointer dog, of a fawn colour, with markings of a deeper shade, had been lately seen in the scrub on the coast-range west of Cardwell. A letter was read from Professor Reinhardt, F.M.Z.S., containing some remarks on the Mexican spider-monkey (*Ateles vellerosus*), particularly in reference to the precise locality of this species. A letter from Mr R. Swinhoe, F.Z.S., was read, respecting a deer seen by him living at Shanghai, which he believed to be *Cervus schomburghki*. A communication was read from Dr. J. L. Le Conte on Platypsyllidæ—a proposed new family of Coleoptera, founded on *Platypsillus castoris*—an insect parasitic on the beaver. A communication was read from Messrs. A. G. Butler and H. Druce, containing a list of the Lepidoptera which had been collected by Dr. Van Patten in Costa Rica. The number of species enumerated was 462, and of these 105 were new to science when obtained. A communication was read by Mr. J. Brazier, C.M.Z.S., containing remarks upon certain Australian and Western Polynesian land shells. A paper by Mr. W. H. Hudson, C.M.Z.S., was read, in which he gave an account of the habits of the "churincho" (*Pyrocephalus rubineus*), as observed by him in and about Buenos Ayres city. A communication was read from Capt. F. W Hutton, C.M.Z.S., containing descriptions of some new star-fishes from New Zealand. Mr. R. Swinhoe, F.Z.S., H.B.M's Consul at Ningpo, communicated some notes on Chinese mammals observed by him near Ningpo, and drew particular attention to a species of Muntjac from the hills at the back of Hangchow city, which he considered to be new, and described as *Cervulus sclateri*.

NOVEMBER 19th, 1872.—Viscount Walden, F.R.S., President, in the chair. Mr. Sclater called attention to the two Livingstone expeditions into the interior of Africa now in preparation, and urged the importance of endeavouring to have zoological collections made in the countries about to be traversed by them. Mr A. D. Bartlett read some notes on the birth of the hippopotamus which had been announced at the last meeting of the Society. Mr Bartlett called particular attention to the fact that on one occasion the young one appeared to have remained under water without coming to the surface to breathe for nearly fifteen minutes, and also pointed out that this was the first instance of the hippopotamus suckling her young in captivity. A communication was read from Mr W. H. Hudson, C.M.Z.S., of Buenos Ayres, containing notes on the habits of the vizcacha (*Lagostomus trichodactylus*), and giving some interesting details of its manner of forming burrows and living in society with other animals. A communication was read from Mr. George Gulliver, F.R.S., containing observations on the size of the red corpuscles of the blood of the salmonidæ, and of some other vertebrates. Dr. A. Gunther, F.R.S., gave a notice of a snake from Robben Island, South Africa, living in the Society's Gardens, which appeared to belong to a new species proposed to be called *Coronella phocarum*. A communication was read from Mr. J. Brazier, C.M.Z.S., containing a list of the species of *Cassidæ* found on the coast of New South Wales, with remarks on their habits and distribution. A communication was read from Mr. Andrew Garrett, of Tahiti, in which he gave a list of the species of *Mitridæ* collected at Rarotonga, Cook's Islands. A communication was read from Mr. W. H. Hudson, C.M.Z.S., containing some further observations on the swallows of Buenos Ayres, being supplementary to a previous paper on the same subject. A communication was read from Dr. J. E. Gray, F.R.S., containing notes on *Propithecus, Indris*, and other Lemurs (*Lemurina*) in the British Museum.

INSTITUTION OF CIVIL ENGINEERS.

THE first weekly meeting of this Society for the Session 1872-73 was held on Tuesday, the 12th November.—Mr. Hawksley, President, in the chair.

During the recess the rooms of the Institution have been painted and decorated by Messrs. Crace, under the direction of the Architect, Mr. Thos. H. Wyatt, the President of the Royal Institute of British Architects. The meeting-room is the only part in which coloured decoration has been attempted, and the architectural treatment of that room has rendered it by no means an easy problem. Bearing in mind the possible contingency of having at some future period to provide galleries at the ends of the room, the architect introduced two distinct orders. In the lower one the busts are introduced, carried by brackets on trusses, and in the upper division the portraits are hung. The difference between these two portions of the room has been boldly marked. The upper panels have been covered with a delicate green flock paper, well adapted to throw out the pictures. The lower panels are hung with rich maroon-coloured cloth, as a favourable ground for the busts. The pilasters, cornices, and other architectural features of the room are treated in one uniform and neutral tone of colour. The upper cornice and the ceiling are so coloured as to mark and separate the panels and the enrichments. The introduction of cloth in the lower compartments of the walls has contributed to subdue the resonance, which was found to exist from the hard surface of the parian cement. On the first floor landing, in a niche specially constructed for the purpose, a cast of the statue of Telford, by Bailey, as erected in Westminster Abbey, has been placed. This is the gift of Mr. Frank James, Assoc. Inst. C.E., and is a most appropriate present, Telford having occupied the Presidential Chair from 1820 to 1834, and made a handsome bequest to the Institution.

At this meeting the names of thirty candidates, who will be balloted for on the 3rd December, were announced, including three members and twenty-seven associates. A report was brought up from the council, stating that they had, under the provisions of the bye-laws, transferred Mr. George Hardinge, M.A., from the class of associate to that of member; also, that the following candidates had been admitted students of the Institution, viz. Messrs. James Gordon Brickenden, John Shanks Brodie, William Westlake Cadman, Henry Davy, James Richard Fletcher, John Alfred Griffiths, Charles Hastings Mackie, Frank Salter, B. Sc., William Elvin Sant, William Harry Scriven, Edwin James White, and John Hamilton Wicksteed. The discussion upon Professor Abel's paper on "Explosive Agents applied to Industrial Purposes" was continued throughout the evening, and not having been concluded, it was announced that it would be resumed at the meeting on Tuesday, the 19th ult.

NAUTICAL SURVEYING.

NAUTICAL surveying has for many years past formed a very important department of the British Naval Service, and has been carried on under the direction of the Hydrographer to the Admiralty. Many officers have greatly distinguished themselves in this branch of the service, and the officers engaged in it have, as a general rule, shown so much devotion and zeal in the execution of their duties that the charts of many portions of the globe, published under the authority of the Admiralty, are everywhere renowned for their accuracy and general excellence; while the charts of our own coasts and adjacent seas are so nearly perfect as to leave little to be desired beyond occasional revision in cases where banks are shifting in their character, or the depths of water, from other causes, liable to alteration; and such revision is constantly going on. It is almost impossible to exaggerate the importance of the results obtained by the efforts of the officers of the Surveying Service, in opening up distant and dangerous seas, and rendering safe the transit of our vast and valuable commerce to all parts of the world; thereby adding, in the pursuits of peace, to the renown the English Navy has acquired by its services against the enemy. The fact, however, of nautical surveying forming a distinct branch of the service, carried on in vessels fitted out under the auspices of the Hydrographer expressly for surveying duties,

has had the effect of limiting knowledge of the general principles and practice of those duties to the officers engaged in them; so that the great body of naval officers know nothing whatever about surveying, whilst many, if not most of them, arrive at the conclusion that the art is a difficult one, only to be acquired by a long course of special training. Now, this is much to be regretted, as we are most clearly of opinion that every naval officer should be acquainted with the principles and practice of nautical surveying to a limited extent, sufficient, for instance, to enable him to undertake the survey of a bay, fixing accurately dangers which he may fall in with in the course of his voyages, or checking the soundings of a port or harbour where he may happen to anchor, and the survey of which had been made long before.—*Naval Science.*

UNDERGROUND RAILWAYS IN AMERICA.

A SECTION of underground railway has been in operation in America for two and a half years. This section consists of a nine-foot railway tunnel extending under Broadway from Warren to Murray Street. A strong current of pure air, produced by a gigantic blower, moves through the tunnel, which is thus always kept thoroughly ventilated. A handsome passenger car, carrying twenty persons, traverses the track, being moved back and forth by the air current, which acts upon the ends of the car like the wind upon a sail. Many thousands of people have enjoyed the ride on this pneumatic railway, and have expressed their unbounded satisfaction at the complete, effective, and splendid manner of its operation. The noise, cinders, gas, dust, jerks, and other disagreeable accompaniments of the locomotive are done away with, while a speed equal to the ordinary steam train is easily maintained.

The practical success of the pneumatic method for passenger cars was long ago settled. It cannot compete in the open country with the locomotive in point of economy; but for underground rapid transit, in large cities like New York, where the travel is immense and cars are to be despatched every minute or two, the pneumatic system promises to be the most comfortable, and the expense of its running is estimated to be about the same as the locomotive plan.

One of the most singular circumstances connected with the introduction of this pneumatic system has been the action of the present Governor of the State, Hoffman. The amended charter of the Beach Pneumatic Transit Company, which gives authority to carry freight only, was signed by him. The great success of the method and the urgent demands of the citizens of New York for the application of the system to passenger transit induced the Company to ask an extension of their privileges to passenger service.

The plans of operation, construction, and route—the latter being from the Battery under the whole length of Broadway—have been widely discussed by the press and approved by the public. For two successive years both branches of the State Legislature have, by very large majorities, passed the necessary measures authorising the Company to proceed with its works and construct a passenger road; but each year the Governor has withheld his signature and vetoed the enactment, one of his chief assigned reasons being that a city engineer, an appointee of the notorious Sweeny, had advised him that the construction of the works under Broadway would be impracticable. This was in the face of the direct testimony of all the leading architects and several of the most experienced civil engineers that the construction was entirely practicable.

The Governor has, however, signed several other bills for steam roads in New York, one of which, the Vanderbilt, soon it is said to be commenced, is to run under Fourth Avenue; another, the Swan Three-tier, that is a combined underground, surface, and elevated steam railway, is to be located west of Broadway; another, the Gilbert, an elevated steam railway, also to be located west of Broadway. In addition to these passed last year, the Governor had previously approved the Central Underground charter for a steam road, now nearly defunct by its own conditions; also the Sweeny Viaduct charter, for an elevated steam road.

The construction of every one of these roads involves more engineering difficulties than that of the Beach Pneumatic Transit road. The latter has the most central, the straightest and best route; this is admitted by all the engineers.

It will thus be seen that the city of New York is blessed with a superabundance of steam railway charters; but the only corporation that has so far actually done anything underground to meet the wants of the public is the Pneumatic Transit Company. It is a shame that the consummation of this important enterprise should be so delayed. The Legislature meets again in January, when a new Governor will be inaugurated. The Company will renew their application for the privilege of carrying passengers, and as soon as it is granted proceed with the extension of their works.

HENRY CLAYTON, SON, & HOWLETT'S, PATENT PEAT MACHINERY.

IT is well-known that peat in its native condition, or as dug, contains a very large percentage of water, of this only a small portion is "loose, or free water," which can be easily extracted by means of draining or squeezing, the great bulk, however, of the water is "locked up," confined in the rooty or fibrous portion of the peat, and cannot be got rid of by the above simple means, nor indeed by pressure, however powerful, while the peat remains in its natural condition. So retentive is peat of this fixed water that, as ordinarily made up for fuel, it will be found, even after some months of drying, to still contain from 15 to 25 per cent. of water.

The objects aimed at by Messrs. Clayton in their patented process are- firstly, to get rid of as much water as possible by drainage and squeezing, then to thoroughly cut up the fibrous or rooty portion, releasing the great quantity of water and air which was previously fast in the fibre, and reducing the whole to a uniform state of pulp. Peat thus prepared will freely part with the whole of its moisture by evaporation, will dry rapidly, and in so doing will consolidate itself, and naturally acquire a density which no pressure of the peat in its natural state could produce, becoming as compact and hard as oak, and of a specific gravity nearly equal to coal. In this state it is (unlike the common prepared peat) as non-absorbant of water as coal itself. To accomplish, then, these objects, with peat direct from the bog, the peat is in the first instance filled as dug into our patented squeezing trucks, and during its conveyance from the bog to the machine the greater part of the "free water" is pressed from the raw peat by a simple and easy means. From these trucks the peat is discharged into the machine (constructed and patented by Messrs Clayton), which in its action continuously cuts up the fibrous portions of the peat, thereby entirely destroying its natural spongy nature. In its travel through the machine, the material further undergoes a moderate amount of pressure, and acquires a density and form permitting it to be discharged and deposited upon portable trays in blocks or briquettes of convenient size, and thence conveyed by a simple and labour-saving contrivance to the drying sheds.

The complete set of machinery is, it is stated, effectually operated by an 8-horse-power engine, and is capable of working up from 60 to 100 tons of moist peat per day into blocks, producing (according to size) from 15,000 to 20,000 pieces of the prepared and moulded peat ready for drying.

This machinery and plant comprises the steam-engine, the ironwork for forming 150 feet of tramway, three squeezing trucks and chains, the macerating and moulding machine complete with pattern of the portable trays, and rollers and runners for forming 100 feet of delivery way into drying shed.

In addition to the cost of the machinery and plant described, Messrs. Clayton charge a moderate royalty, to be agreed upon at the time of purchase.

THE ELECTRO-STANNUS PROCESS OF PLATING.

THIS process of plating is effected by means of a cheap white metal, of which tin is the preponderating ingredient, and which will attach itself to all metals except zinc. It is extremely simple, rapid, and inexpensive, but of course nothing short of a practical trial can successfully demonstrate its fitness for the various purposes to which it is proposed to apply it. The articles to be plated are first thrown into a bath of weak sulphuric acid and water, and, all surface impurities having thus been loosened, the goods are placed in a second bath of strong boiling potash lye, where a complete chemical cleanness is effected. They are then suspended in a vat containing a solution of metal, and having remained there for a longer or a shorter time according to the thickness of the deposit required, are "scratched" by a rapidly revolving wire brush, and are then ready to return to the customer. On emerging from the vat the articles are of a dull leaden colour, but they are susceptible of an extremely high polish, and even after passing under the wire brush assume a brilliancy very little short of that of polished silver. Experiments made upon articles completely eaten by rust have been successful, the articles assuming the appearance of frosted silver, and some gun furniture very finely chased has been coated with the deposit in such a manner as to preserve every trace of the original design. One of the chief advantages of the new method is stated to be that it obviates the liability of iron and steel goods to rust, and another feature in its application will probably result from the fact that electroplated goods can now be prepared to receive their coat of silver by a white undercoat of metal which will prevent the disagreeable effect at present so apparent in these articles, produced by the yellow glint of the original copper deposit showing through the worn silver coating.

The deposited metal is as white as silver, its cost is considerably less; whilst its entire freedom from oxidation renders it for many purposes superior to the more expensive metal.

The process is adapted to most of the Birmingham trades, and is particularly applicable to such goods as light steel toys, harness fittings, spurs, sofa and bedstead springs, fenders, the bright parts of sewing machines, bedsteads, gas fittings, locks, keys, hinges, coffin furniture, cooking utensils, pins, and in fact almost all descriptions of ironmongery goods, and it can be applied successfully to renovate worn and tarnished dish covers, and other similar goods.

Samples of goods finished by the new process are now on view at the works of the Electro-Stannus Company, 22, Vittoria Street, Birmingham. The managing director attends there from half-past ten to one o'clock daily, and will be happy to exhibit the specimens to any one interested, upon presentation of a business card. The company has a London office at 1, Tokenhouse Yard, E C.

FELT ROOFING.

THE *Revue Hebdomadaire de Chimie*, in giving an account of asphaltic roofing felt as applied to the *Dépôt du Havre*, states that after it has been nailed on it should receive a coating of gas-tar and lime well mixed together and then applied with a brush, and for roofs which are to be permanent this coating should be renewed every four or five years.

MEASUREMENT OF SHIPS.

SOME persons entirely disapprove of the employment of any system of measurement by internal capacity, on the ground that it introduces unnecessary confusion into the use of the terms "ton" and "tonnage"; as an alternative, they advocate the adoption of so-called "dead-weight" measurement—that is to say, would express the tonnage of a ship by the number of tons-weight of cargo carried. Such a scheme admits of being applied in either of two ways: first, to fix the maximum load draught line, beyond which the vessel is not to be immersed, and then to estimate the displacement, in tons avoirdupois, between this line and the light draught line, at which the vessel floats when she has no cargo on board; second, to allow the tonnage to vary according to the amount of cargo embarked, estimating its weight by means of an officially guaranteed curve of displacement for each ship, on which the light draught line should be marked, and the actual draught at any time could be set off readily. These suggestions have the recommendation of great apparent simplicity, but are open to many serious objections. For example, their adoption would entirely revolutionise the nominal aggregate tonnage of the British mercantile marine; and this would be no small evil, as is proved by the fact that all previous changes in the law have been intentionally so made as to leave the aggregate tonnage unchanged, the arbitrary divisors being so chosen as to give this result very nearly. As to the second mode of using this dead-weight tonnage little need be said. There are obvious objections to having a varying tonnage for every ship, and it would open the way to possible evasions and disputes. Nor is the first mode more likely to commend itself; for it necessitates first of all the fixing of the load-line for each ship, and thus opens up a wide field for discussion, embracing the disputed question of freeboard in its relation to breadth and depth, as well as interfering with the freedom of private enterprise to an extent which has never yet been sanctioned. On the whole, therefore, it seems preferable to continue the use of the present Register Tonnage Measurement for all merchant shipping; the internal capacity being a fixed and ascertainable quantity, regulating the amount of cargo that can ordinarily be stowed, and governing the stowage far more, under most circumstances, than anything beside.—*Naval Science.*

Foreign Electrical Science.

Academie des Sciences, No. 15, October 17.

Galvanic Reduction of Iron under the Influence of an Electro-magnetic Solenoid.—By M. Dumas, in the name of M. Jacobi.—The laws laid down in this pamphlet submitted to the Academy have been previously made known to electricians by M. Jacobi.

The Induction Currents developed in Gramme's Machine.—By M. J. M. Gaugain.—The completion of an exhaustive paper on this subject. The first communication appeared in the *Comptes Rendus*, t. lxxiv., p. 138. The experiments show that currents of varying intensity are obtained with variation in speed of the coil of the machine Comprehension of the other results depends upon a knowledge of the former paper.

The Efficiency of Lightning Conductors.—By M. W. de Fonvielle.—A statement of the result of M. de Fonvielle's visit of inspection to England as member of the Commission presided over by Mr. James Glaisher. St. Paul's Cathedral is considered to be the model upon which buildings should be fitted with conductors.

No. 16. October 14.

On the Action of Conductors disposed symmetrically about an Electroscope.—By M. Ch. V. Zenger.—It is known that static electricity always appears upon the surface of conductors; and the conditions under which there is neither communication nor induction of electricity by an electrified conductor on an interior body, conductor or not, are:—1. That the two bodies should be in contact at the moment of charging. 2. That the exterior conductor be disposed symmetrically around the interior body, in order to protect against electrical induction. This electrical inertia can be shown by the following apparatus. In the middle of a circular plate of brass, insulated on a glass foot, is arranged a delicate gold-leaf electroscope, enclosed in glass, and terminating in a button of brass, to which is fixed wires of brass bent in different forms, but so symmetrically arranged that by further bending bodies of revolution, for example, a sphere or a paraboloid may be obtained; the axis of rotation is in the direction of the gold leaves. This apparatus when charged so that sparks are given from the wires shows upon the gold leaves no trace of electricity. The wires may be cut without affecting the leaves; but directly the symmetry of the body is destroyed the gold leaves are set in motion.

On the Action of Carbon-dust heaped around the Negative Electrode in Carbon Piles.—Note by M. Th. du Moncel. This interesting paper we shall give in detail.

No. 17. October 21.

A Note by M. Malessart relative to a new electromotor, obtained by a particular disposition of the electro-magnets

Annales de Chimie et de Physique. October.

This number contains no information relating to electricity.

Annalen der Physik und Chemie. No. 8 & 9.

These numbers contain nothing relating to electricity, but there is a translation of Professor Wright's paper "*On the Influence of Ozone upon Vulcanised India-rubber.*"

Polytechnisches Journal (Dingler). Band cov., Heft 5.

This number contains no article of interest in the branch of physical science to which we give attention.

Les Mondes, October 10.

Demonstration of the Formulæ of Two Currents.—By M. J. Bertrand.—A note upon Ampère's law.

Bulletin du Musée de l'Industrie de Belgique. September.

The Manufacture of Standards of Length by the Galvanotype Process.—By M. Jacobi.

Application of Electricity to the Firing of Mines.—By M. Cuchez.

—*Telegraphic Journal.*

GREAT ST. GOTHARD TUNNEL.

MESSRS. KREBS, of Cologne, in writing to the *Times*, state that they have received a first order for 25 tons of litho-fracteur, and that it is expected that the hardness of the stone through which the tunnel has to be made will require the use of 1500 tons for blasting the rock.

THE INVENTORS' PATENT-RIGHT ASSOCIATION, LIMITED.—This now well-known and ably conducted Association, the prospectus of which appears in the advertising columns, is, as may be seen from the list of recorded specifications, transacting a large patent business. Its organisation for obtaining patents combines so great economy in the charges with sterling efficiency, and its arrangements are so complete for unravelling disputed questions of patent-right, that it is gratifying to find former predictions as to its success fully borne out by the results. Members of the Inventors' Institute, to whom, moreover, it affords special advantages for obtaining and maintaining patent-rights, largely avail themselves of the services of the Association.

HANGING WALL PAPER.

MANY persons living in remote places defer repapering their apartments on account of the difficulty of procuring skilled labour in this branch of industry; but it is really such a simple task that there is no reason why anyone of ordinary capacity should not do it with as little trouble as white-washing. The directions here given are the result of practical experience and, if observed, will enable anyone to hang paper as well as an expert.

Supposing you have decided to paper your apartment anew: the first thing to be done is to remove the old paper; if there is but one thickness on the wall it is not necessary as this will do no harm. It is only when layer after layer is put on that the apartment becomes offensive from the condensation of vapours accumulating with years, until at last they become dangerous sources of disease. This is a well-established fact, as recent investigation by a Board of Health in London disclosed that the several layers or thicknesses of wall paper in houses, in a crowded part of the city, were absolutely damp with noisome deposits accruing from defective ventilation.

To remove the old paper, take a common whitewash brush and a pail of water. Wash the wall all over, and you can easily tear the paper off in long sheets and so render the surface clean again. Care must be taken not to remove or break the surface of the under layer, or ground; for if this is done there will be a ridge or seam wherever it is torn that will show badly if your new paper has a light ground; if it is dark and the pattern is in arabesque it matters little as it will not show.

Having cleaned or removed the old paper, take a roll of the new that you desire to apply and hold it up to the wall; arrange it so that the pattern will show evenly at top and bottom, if possible, and then cut off one length. Have ready a table or a board long enough to take the whole piece; then use the first strip cut as a guide, and match all the rest to it. You may cut all the paper up for the straight part of the wall, leaving the intervals over the door and windows to be done at leisure, or with the waste pieces that always accumulate. In cutting the length be careful to cut the bottoms and tops perfectly square across, and not zigzag or at haphazard, for it looks badly to see the pattern mismatched, or a ragged end where it meets the washboard.

There are two white edges or salvages on wall paper, one of which must be cut off. Be sure and cut off the right one, or the one that you intend to paper from, and cut all the others at one time. In applying the paper you will doubtless find that between the doors and windows the pattern will not come out right, leaving a hand's breadth or so to fill up between the frame and the last piece applied. This is of no consequence, as it can be easily filled up by a piece specially cut for it. Be careful and see that you do not reverse the paper or get it upside down in hanging. You can easily tell the right side up if the pattern is in vines, leaves, or geometrical shapes, by noticing which side the shading of the figures is on.

Having cut all the paper ready to apply, roll it up and lay each piece on one side, or lay them all in a pile. Have ready a smooth boiled paste of wheat flour (sound flour, not sour), a whitewash brush, and a board or table long enough to take the whole sheet in one length. Make the paste quite thin, not thicker than molasses, and as smooth as a custard. Have a chair, step-ladder, or table ready, on which you can stand and reach to the top of the wall. Then take your first piece of paper, lay it on the table and apply the paste; not too thickly, being particular to touch the edges, and top and bottom well. Then take the sheet by the top, raise it off of the table and support it with one arm (on the right or dry side, of course), and put it up to the wall. Keep it entirely clear of the wall until you fasten the head of the sheet, but previous to this run your eye down the side and see if it hangs square with the door-frame. If it does

have a clean towel or cloth ready, and move it horizontally in wavy strokes over the sheet until the bottom is reached, but do not in any case rub up and down or draw the paper in folds; if you do there will be ridges and wrinkles in it, which destroy the appearance, and can never be got out. Hang the sheet properly at first, and then follow it down from the top, rubbing across it, and there will not be a wrinkle in it. Apply the second sheet in the same way, and be careful that you match the figures properly. Success depends on this, for nothing looks worse than to see the continuity broken off, or a white seam showing between the pattern up and down the wall where the sheets do not meet. When the corner is reached, if the sheet does not come evenly to the opposite wall, it is better to cut it lengthwise and paste it on; then take the fellow to the piece and apply it also, matching the figures of course. If you endeavour to make the sheet reach round you will make a bad job of it. Always clean well the table where you paste, so that no paste will get on the pattern; if it does the colours will run or smudge, and soil the sheet. Gilt papers, with delicate lavender grounds, require great care in this respect, as the least spot shows badly. This is all there is to be observed in hanging paper, and there is nothing that anyone cannot do with a little practice.

NEW GALVANIC PILE.

A NEW galvanic pile, invented by M. Morin, is intended to avoid the inconvenience caused by the deposit of copper upon the surface of the zinc or upon the porous cup. The pile consists of a cylinder of copper surrounded by a concentric cylinder of zinc, between which two cylinders is a third cylinder of filtering paper. There is difference enough in the size of those cylinders to leave concentric annular spaces between the paper and the copper, and the paper and the zinc. The former space is filled with sand, and the latter with a stratum of flowers of sulphur. The whole is immersed in sulphate of copper.

Such a pile, it is said, has operated during five months with so little variation that the inventor believes it would work equally well for an additional five. During these five months the current has been continuous without the need of once touching the battery.

FORMATION OF CERTAIN METALLIC SULPHIDES.

PRIVOZNICK finds that copper, in contact with sulphuretted sulphide of ammonium, is transformed into a blue bisulphide and a protosulphide. This is a means for obtaining the sulphides of ammonium, potassium, and sodium in a colourless state. Silver becomes covered with a grey crystalline crust of sulphide of silver. Tin and nickel dissolve in appreciable quantities in the polysulphides of ammonium. Iron is covered with a black deposit. The solutions of hyposulphide of soda transform also slowly copper and silver into sulphides, with the formation of sulphide of soda.

Correspondence.

*** Discussion is invited upon any subject within the scope of the SCIENTIFIC REVIEW in which its readers may be interested; but correspondents are requested to be brief, as space is limited, and to remember that each individual writer is alone responsible for the opinions he may express.

MECHANICAL PUDDLING.

To the Editor of the SCIENTIFIC REVIEW.

SIR,—I think that if Mr. W. H. Tooth had not a most treacherous memory he would full well recollect having seen my sketch upon this subject when first issued in 1868, and that I had therein given him unreservedly credit for being the first inventor of a rotary puddling furnace. I even mention his connection with Mr. Heaton in the early experiments, and to which he alludes in his letter, and, furthermore, I assert on his behalf that mechanically the "churn" (W. H. T.'s) has not up to the present time been at all improved upon.

I have not any wish to appear in borrowed plumes, and had W. H. T. retained fresh in his recollection my remarks in their entirety, rather than only your abstracts and your review, I think he would have refrained from the comments contained in his letter which you published in your November issue.

I must say that I am not a little amused with his manner of describing me, as though I was someone wholly unknown to him, considering our very close relationship since 1860 in patent and business matters connected with mechanical puddling and other inventions. The first vowel prefix, "a" Mr. William Yates, is rather a high move, and his distant grandeur mighty fine, but it may, perhaps, be convenient to him to assume to have forgotten the frequent holder of sundry memoranda bearing his signature.

I am, Sir, yours truly,
WILLIAM YATES.

24, Duke Street, Westminster.
November 20th, 1872.

NOTICE.—For the articles on the Woolwich Infant and the Machinery of Ships of War which appeared in our November number, we were indebted to that able quarterly *Naval Science*.

APPLICATIONS FOR LETTERS PATENT.

(*Continued from page 174.*)

Signalling apparatus for colliery, railway, and other purposes or uses 3024. R. S. Moss and W. J. Crighton. Blinds and shutters for shop fronts, dwelling-houses, and other purposes.—3025. J. Elce and H. B. Arundel. Machinery for preparing cotton and other fibrous substances.—3026. R. France. Stoppers for bottles containing aerated or gaseous liquids.—3027. J. Sutcliffe and D. Parker. Warping and sizing cotton or any other yarn, and in apparatus connected therewith.—3028. H. Y. D. Scott. Sewage.

On October 15th.—3029 to 3045.—T. S. Morris. Steam boilers.—D. Pidgeon and W. Manwaring. Reaping machines.—R. Atkin. Construction of ships and other navigable vessels, and in means for propelling, ventilating, and steering the same.—J. Hargreaves and T. Robinson. Treating sulphides, and in obtaining products therefrom.—E. A. Pontifex and J. Barton. Water-waste preventors.—J. J. Baranowski and J. Skwarcow. Machine for fixing and compressing capsules on bottles and like vessels.—A. C. Bamlett. Reaping and mowing machines.—R. Taylor and M. Duckers. Looms for weaving checks and other similar fabrics.—J. Huggett and J. A. Huggett. Horse nails, and in apparatus employed in such manufacture.—F. G. Underhay. Water-waste preventors.—J. Legge. Furnaces for reheating iron.—P. Maccallum. New or improved artificial fuel.—J. Steel. Cooling liquids, and in the machinery or apparatus employed therefor.—J. Sims and C. Holmes. Heating conservatories, places of worship, and all public buildings.—W. R. Lake. Chairs (com.)—A. V. Newton. Trusses (com.)—W. W. Symington. Power looms.

On October 16th.—3046 to 3058.—J. McNaught and W. McNaught. Scouring and washing wool or other fibrous substances.—J. Mackay. Machinery or apparatus for ruling paper.—C. W. Kayser. Wire drawing.—H. Tugby. Kilns for burning bricks, pipes, tiles, and earthenware generally, and for other similar purposes.—E. Walker and W. Clarke. Apparatus or appliances for retarding and stopping the travel of wire and other ropes and chains, and in apparatus for lifting purposes.—W. A. Gilbee. Harmoniums and other similar free-reed instruments (com.) (Complete Specification.)—J. Hargreaves and T. Robinson. Sulphates of soda and potash.—N. Wilson. Sewing machines.—W. B. Silverlock. Closing bottles, flasks, casks, or other vessels.—G. Clark. Shoes and boots.—A. V. Newton. Manufacture of iron and steel wire (com.)—J. J. Shedlock. Apparatus for the treatment of hydrocarbon gases and vapours for illuminating and heating purposes.—J. F. Shedlock. Improved rymer and counter bore (com.)

On October 17th.—3059 to 3074.—G. P. Dodge. Hand-warmer or muff (com.)—J. W. France. Means or apparatus for promoting the combustion of fuel.—J. Hamilton and R. Paterson. Soldering bolts.—A. R. Stocker. Appendages now in general use for connecting and holding together the various limbs of infants' feeding-bottles, part of which articles, process, and means are applicable to other purposes.—F. Rigollot. Sluice valves for regulating and indicating the flow of fluids, parts of which improvements are applicable to cocks.—J. T. Dann. Apparatus for the production of heat (com.)—W. Morgan-Brown. Breech-loading ordnance and cartridges for the same (com.)—J. Martin and J. A. Wheeler. Raising and tilting casks containing liquids.—W. Morgan-Brown. Composition for preserving wood, metal, stone, brick, paper, textile and felted fabrics, cordage, and cables (com.)—J. M. Trémaux. Pistons and other purposes.—C. Ferranti and E. J. Turner. Artistic treatment of photographic portraits.—T. Coleby. Machinery and apparatus for reeling and tieing up hanks or skeins of yarn or thread.—J. Hird and E. Ensor. Improved stopper for closing the mouths of bottles and other vessels for containing liquids.—J. Peach and W. Gray. Traps for birds and other animals.—W. R. Ashwell. Kilns and apparatus suitable for drying and burning bricks and tiles, and in utilising the waste heat therefrom.—J. H. Johnson and P. M. Shanks. Printing machines.

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THE

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* "Com.)" means "Invention communicated from abroad."

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Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE.

JANUARY 1, 1873.

PROPOSED ALTERATIONS IN THE *SCIENTIFIC REVIEW.*

TO OUR READERS.

For some time we have contemplated an alteration in the character and contents of the Scientific Review, which we are persuaded will be approved of by our subscribers generally. In our reviews and notices of books we have hitherto almost exclusively confined our attention to works treating of scientific subjects, though we have frequently questioned ourselves as to the propriety of shutting out other book notices, which we were convinced could not fail to be very interesting to our readers.

After mature consideration we have decided to deal more liberally, and we think more judiciously, with general literature, and we have decided to do this in the interests of science.

We can no longer shut our eyes to the fact that the investigations of science penetrate into every walk of life. The business, the arts, and even the amusements of life are at the present day almost necessarily scientific. Pure scientific investigation for its own sake is far more common than ever. But scientific experiments and applications shoot out in all directions from these. No branch of the fine arts can be pursued so as to secure high results unless its details are worked out with scientific accuracy, and by aid of scientific knowledge. No kind of manufacture can be successful unless every aid science can lend has been called into requisition. In the boundless fields of nature countless auxiliaries are to be found to help man in every task the duties or interests of life can impose, or the genius of investigation prompt. But on the other hand, as practical science extends the sphere of its usefulness in aid of the ordinary duties of life, so the efforts of imagination speculating on the wonders that may be realised, stimulate the activity of the discoverer and the inventor. The practical and imaginative intellect act and re-act on each other, or rather touch and intermix, until by the efforts of both, what at one time appeared the vaguest hope becomes the common prosaic fact of life. For this reason we feel that whatever is to be found in works of travel or fiction, or in the writings of our poets, should, under certain conditions of critical selection, engage the attention of the scientific reader and thinker.

The conditions of life in every one of its spheres of action may be regulated by scientific thought. It is not only in such works as constructing a steam-engine, adjusting the conditions of a railway, or providing for the electric transmission of thought, that the application of science should be looked for. The Duke of Somerset said truly the other day at Newtown Abbot that the great gains to society during the last two hundred years had been obtained chiefly by the labours of our men of science, and not by the desultory scheming of our politicians, and that the reason why Governments have failed is that statesmen have worked without any scientific foundation or calculation for their proceedings. Whether this be true absolutely or only partially, it suggests a most important question—Whether scientific thought might not be brought to bear on the work of Government in such a way as to prevent those social anomalies and disasters which afflict society at the present moment, chiefly because science and invention have given us a larger power of creating and obtaining wealth than we know how to distribute properly amongst our people by the present haphazard rule-of-thumb system in operation.

In the scientific world something useful on this subject may be struck out, and it is with the view that we have decided to enlarge the scope of our duties—to change our *Scientific Review* into a *Scientific and Literary Review*—to examine books of all sorts as depositories of thought, and to get from each whatever may enlighten, stimulate, and assist the scientific inquirer; and therefore we shall not hesitate, when the opportunity offers itself, to consider social and even political problems.

What we are already doing will be continued, but we shall endeavour to turn in upon our pages other fructifying streams of thought in connection with literature, pleasant and even useful to those engaged in scientific investigation. We shall also occasionally notice events in connection with art and the drama, so as to furnish an interesting monthly account of whatever transpires interesting to the intelligent and educated reader.

We hope our subscribers will aid us in this work by furnishing our pages with any special information they may possess.

Scientific men, artists, and others have no doubt much to communicate to each other, and will have to help each other more effectually in the future than they have in the past before, by the united efforts of all, the many improvements needed by society can be effected. It is not necessary to believe in any near approach of the Millennium to urge this co-operation of diversified thought and effort, or to hope that we can immediately restore the dissonance to harmony in society, and make the jarring individual be a chord that in the general consecration bears part with all in musical relation.

But much can nevertheless be done by well-meant and rightly-directed effort to bring about changes in which all may rejoice.

What we propose doing in the *Scientific Review* may not be much, but every service honestly rendered counts for something, and it is in this spirit that we ask our subscribers and readers to give us their support, and, where such a thing can be done with propriety, to recommend us to the attention of readers not in the fullest sense of the term scientific readers.

OUR SHIPS AND OUR GUNS.

It was a sad day for Britain when the old faith in her wooden walls was shaken and destroyed by iron vessels supplanting our renowned hearts of oak. Not that we found any cause for regret so long as we were content to direct our attention to perfecting our naval structures by substituting iron for wood and suitably improving their form and construction by the scientific application of metal for then all went well—vessels of less draught and greater capacity delighted and benefitted us, but presently it was suggested that our war-ships might by means of iron be made impregnable—and here our troubles began. Our military marine system was forthwith turned topsy-turvy, the object being not so much to build ships, as to erect sea-monsters that should deal out death and destruction all around, and yet be themselves unattackable, except with the almost certain result of destruction to the attacker. Of course our inventors were ready for the occasion, and much was done to carry out this *desideratum*; but no sooner was that much achieved than the idea was broached that although these structures might be impregnable when attacked by ordnance hitherto used, they could readily be made to succumb to the action of heavier artillery able to discharge more powerful and penetrating shot. Forthwith bigger guns were planned and manufactured, designed for the use of heavier and more irresistible projectiles, and again inventive genius exercised itself in armouring our ships and strengthening the structure of our vessels; whereupon another set of inventors then occupied themselves with further improving and rendering more effective our big guns, so that the dreadful sea-monsters themselves have been made to tremble at the great cannon's roar. By these proceedings, however, our vessels have been rendered so huge and unwieldy as no longer to be properly denominated ships, but floating batteries; and the big guns have grown so big and immovable as to be incapable of being worked, except by the aid of complicated mechanism. But this state of things has not daunted or dispirited our inventors, who are always ready to grapple with untoward events, and the same course of improving and improving is ever proceeding, with the old spirit. Still more gigantic ships are opposed by still more gigantic guns, and no termination of the game seems likely to ensue.

However, John Bull is beginning to grumble (some people say he always *is* grumbling), and keeps on asking, *Cui bono?* —is he to go on for ever paying the piper, and yet never witness the performance of a satisfactory dance? Are armour-plated ships to be the proper thing to-day, and improved big guns to render them of no account to-morrow? And, above

all, are we not engaged in the pursuit of a will-o'-the-wisp, which is ever close to our grasp and yet ever beyond it? There must surely be a practical limit to the increase of the bulk of our ships and the size of our cannon, which can be arrived at by study and experiment without resorting to actual trials on a large scale at immense expense. It may be a grand exploit to pile Pelion on Ossa, but we regard it as one that in the end will lead to the practical result of leaving us "as you were."

We have not in the foregoing remarks taken into consideration a most important element in these matters—namely, the torpedoes or submarine projectiles, though these must be duly considered when dealing with the question of ships and guns, for it is quite clear that they will play a most important part in the maritime warfare of the future. Nor have we given any consideration to the notion that the steam cannon can be rendered a practical and powerful instrument of warfare, although we incline to the opinion that a powerful war-engine of that kind could be devised. All the matters above referred to require to be duly weighed and submitted to the test experiment before large sums are spent upon any one object; but this is not the present practice with our Government, as comes out very strongly in the case of the *Woolwich Infant*, as it is termed, upon which single cannon something like three thousand pounds was spent, and yet it failed upon the seventy-third discharge, and then, a few months' quiet interval being allowed, the *Infant* was transferred to the factories to be cut in two transversely where the B coil and B tube are hooked together, in order that the old steel barrel and cascable might be bored out and new ones substituted, and a new B coil shrunk on. For the sum of about £700 the gun is to be rebuilt and be ready to begin a new life, but whether that new life be short or long depends, if the gun be used, upon a correct appreciation of the suicidal tendencies which shortened the old one.

Thus the old, old system of trial and error seems to be the only one adopted by our Government, and we confess we have no hope that any improvement in this respect will be effected within any reasonable period of time. But it is a matter of national concern that a fair and careful consideration should be given to the question whether, due regard being had to all the circumstances of the case, any ship really can be built that will be equal to the requirements of a sea-going vessel, and at the same time will be able to resist a heavy cannonade from the biggest guns that can be used to assail it. The only reliable course seems to us to be the adoption of Captain Moody's star principle of construction, more with the view of producing a navigable floating battery than a ship, that could, if need be, have a tender accompanying it which should be a swift vessel that could act as a tug when needful.

After all, it may be well to carefully consider if this highly-expensive game of constructing impregnable vessels is worth pursuing, for nobody can say whether big guns or big ships will ultimately triumph. For ourselves, we incline to the opinion that guns for forts and batteries can be so constructed as to be perfect annihilators of any ships, however well armoured, and that any vessel in order to have any chance of resisting the action of such guns must be made so large and unwieldy as to be thoroughly unmanageable in a heavy sea; and it would seem to be a wiser course for sea-going war-ships to be built so that they are good sailors, can easily shift their position, and be armed with sufficiently powerful artillery, than to pursue this chase in search of invulnerability for them.

Reviews.

Records of the Rocks; or, Notes on the Geology, Natural History, and Antiquities of North and South Wales, Devon, and Cornwall. By Rev. W. S. Symonds, F.G.S. With numerous illustrations. London: John Murray, Albemarle Street.

This is a pleasant and instructive work, in which not only the geological structure and natural history, but also the antiquities of the districts above-mentioned are brought under the notice of its readers. It appears that the work is the result of an accumulation of notes on natural history, stored during several years when travelling on geological expeditions throughout the districts on which it treats, and the author states that it is written for amateurs who, like himself, enjoy passing their leisure hours among rocks, old castles, old authors, and the wild flowers of strange wayside places. It does not assume to be a strictly scientific description of the geological structure of the different tracts of country to which it alludes, but he trusts it is correct as far as it goes.

The volume is enriched by sketches of scenery from the pencil of the author's friend and frequent companion, Sir William Guise, Bart., and by the reproduction of many plates of landscapes, fossils, and sections from that well-known scientific work, "Siluria," by Sir Roderick Murchison.

Thanks are tendered to Miss Dora Baker, of Hasfield Court, Gloucestershire, for illustrations of some of the typical fossils, and to Miss Roberts, of Hazeldine, Red Marley, for efficient aid in carrying the MSS. through the press, and for the copious Index, which we can say is worthy of commendation.

The work opens with a general review of ancient astronomy and cosmogonic knowledge, and then proceeds to treat of Laurentian Rocks, afterwards describing the Cambrian Rocks, the Lower, Middle, and Upper Silurians Old Red Sandstone, and then refers to the Devonian Rocks, and from this part of the work we quote the following:—

MIDDLE DEVONIANS.

It is not possible to examine the Combe Martin district properly without sojourning awhile in the immediate neighbourhood. The little town itself is long and irregular, with an interesting church and a fine perpendicular tower. There is good sea fishing off the cliffs, and it is by far the best locality in North Devon for collecting the fossils of the Middle Devonians, while the botanist cannot fail to obtain many interesting plants; amongst them he may see the green Laver of the epicure collected in great quantities, it is preserved for winter consumption.

Under the Little Hangman I obtained a number of well-preserved fossils in red grits; *in situ*, they occur about half-way up the cliff, and fall in masses on the shore. Among them were Stringocephalus, Burtini, Natica, and large Myalinæ. The junction of these beds runs up the road from Combe Martin to Knap Down Mine, but the plan to obtain good fossils is to take a boat and land under the cliffs.

Boating from Combe Martin round the Point, we see a decomposing volcanic rock traversing the slates. I could not make out whether it was a contemporaneously bedded trap, or an erupted dyke, but I expect it is the former weathering on its edges. Rounding the Headland, a red and yellow conglomerate is seen to lie between the satiny slates and the fossiliferous red rocks of the Little Hangman. A cliff path, called the Miner's Path, leads from the beach up to the summit of the cliff, from whence the explorer may walk back to Combe Martin. Some good plants flourish on the Little Hangman cliffs, and report says that the Maiden Hair fern (Adiantum Capillus Veneris) grows here in one or two localities. At all events, my boatman pointed out a light green streak which he declared was this much-coveted botanical treasure. When I was last at Combe Martin there was a good section on the road between the town and Watermouth, in the limestone and slaty rocks that pass into the Ilfracombe group. Numerous Devonian corals have been found in these beds, with trilobites and the Silurian shell Atrypa reticularis.

"It is these limestones," says Mr. Etheridge, "which so eminently characterise the Middle Devonians, and, as on the Continent, contain that peculiar group of corals totally unlike and different from those of the underlying Silurian rocks, as well as, without exception, the Carboniferous; for of the fifty species of coral known as the Middle Devonian series of North and South Devon and Cornwall, one doubtful species only is said to occur in the Silurian rocks—viz., Favosites fibrosa—and only one is said to pass up into the Carboniferous series—viz., Amplexus tortuosus—of which, however, we have no authentic evidence."

The geologist cannot do better than follow the rocks by the coast series from the bay at Combe Martin to Ilfracombe, as they are far easier to read off there than inland. Hagginton Hill quarry is famous for its fossils. They include Atrypa reticularis, Rhynconella pleurodon, and Spirifers of several species. Fossils may be found at the headland of Helesborough. Mr. Valpey, a gentleman who geologised the Ilfracombe district, obtained many specimens from the Helesborough beds. Among them are some fish spines. I saw a small ichthyodorulite in some siliceous beds, but unluckily broke it with the hammer. There are numerous brachiopods, but they are badly preserved; indeed I never obtained a well defined fossil from this headland.

A visit should be made from Ilfracombe to Muddiford, to examine the volcanic rock which is poured over the Morte slates, and apparently bedded with them. It consists of a greenish felstone porphyry. Another igneous rock occurs in the coast section near Rockham, between Ilfracombe and Morthoe; it may be seen by crossing the little river to the rocks at the mouth of the stream. This trap is not on the same horizon as the Muddiford or Bittadore porphyry, for that porphyry is nearer the junction of the Morte slates with the red sandstones by which they are overlaid at Swinham Down and Pickwell Down.

At Rockham Bay, the Devonian Morte slates are traversed by a number of quartz veins, the result of fracture and segregation of the quartzite in the fissures. The slates are much folded, and when in a boat off Bull Point I observed a rock which looked like a dyke elevating the slates at a high angle, but I was unable to land and examine it *in situ*. These quartz veins are useful to the geologist through N. Devon, as indicating the horizon of the Morte slates, which are unfossiliferous. I have several times traced the coast section from Ilfracombe by the valley of Lee, Rockham, and Morthoe to the Woolacombe sands, but never found a fossil. The geologist may stay at the Barricane Inn when engaged in working out the Morte slates and the mooted question as to whether there is uniformity between the Morthoe and the Woolacombe slates and the overlying sandstones of Pickwell Down, Potter's Hill, and Croscombe. This

may be done by carefully observing the dip of the Morte slates from Morthoe past the Barricane beach (where the beautiful blue Ianthina of the Mediterranean may sometimes be found living amongst the shells) to the place where they abut against the Woolacombe sands, and where they show signs of having their dip reversed. Not quite half-way across the sands is a stream of water which flows under Potter's Hill, and this stream occupies *a line of fault*, the Morte beds consisting of dark slates and bands of quartz, with a nearly vertical dip, being thrown off at an angle in a direction opposite to the Pickwell Down beds. I think there is here, distinctly traceable, a line of fracture between the Pickwell Down beds and the Morte slates, and that this fracture runs between the same beds at Liddon Hill, near Dulverton, many miles to the eastward. Nevertheless, as the Pickwell Down beds are seen above Venetian dipping at an angle which would carry them far over the Morte slates, the fault at Woolacombe may not interfere with the regular succession.

The church at Morthoe has "been done up," as we were assured at Barricane Inn, and for an old church is as much "done for" as new masonry, a new pulpit, and new stained-glass windows can make it, but happily the beautiful carved benches were spared, and the tomb of the Tracey. The latter is a beautiful monument, and well worthy of note. On an altar tomb of white stone, adorned with architectural work, and niches, with figures a good deal dilapidated, but of early thirteenth-century workmanship, rests a slab of black Purbeck stone, on which is an incised effigy of a man, apparently in the garb of a priest, holding in his hand the sacramental cup. The features are entirely obliterated, but on the head the outline of a peculiar cap, not unlike a coronet, is plainly traceable. Round the west and south sides of the slab an inscription is visible, as traced by Sir William Guise it may be read thus:—"Syre Guillame de Traci gist ici Deu de sa alme eyt mercy" Sir William de Tracy lies here: may God on his soul have mercy! That this is the memorial of the bold slayer of Beckett may well be doubted, as the priestly habiliments and the cup of blessing are not emblematic of him; but tradition has it that he was long in hiding in these parts, where his family had possessions—which is very probable Anyway, the effigy is one of great interest, and cannot, I believe, be of later date than early in the thirteenth century.

From a book called "Memorials of Barnstaple," which we met with at the residence of the Rev. Mr. Hall, of Pilton, we made the following extracts. "In the church of this place is a handsome monument said to have been made the depository of the remains of De Tracy, Beckett's murderer, but more generally believed to be that of a clergyman named William Tracy, who died at Morte in 1322, and who, as the title of Sir or Syre was commonly applied to the clergy at that period, had it inscribed on his tomb as a customary thing. The northern side is occupied by some armorial bearings, consisting of three escutcheons: one containing three lions passant gardant, a second three bends, and the third a Saltire."

Close by the church is a mortuary for the reception of those bodies which the sea throws up only too frequently on this dangerous coast. In the winter few weeks pass without tenants for this sad receptacle. At Morthoe I recommend the geologist to obtain a boat and examine the cliff sections (on a fine day!) off Bull Point. There are dykes of igneous rock in the slates, as well as bedded masses of a volcanic conglomerate; and the rock fissures are full of beautiful ferns in the summer time, which are almost eradicated by the eternal fern destroyers in the neighbourhood of Ilfracombe. Here also I saw a Peregrine Falcon, which bred there in 1868; the young birds were sent for hawking purposes to Oxfordshire.

The Middle Devonian rocks from the Little Hangman and Combe Martin to the base of the Pickell Down beds beyond Morthoe, are believed to be the representatives of the great coraline limestones of Plymouth and Torbay, which have furnished so many beautiful specimens to the museum of Mr. Vicary, and also of the Eifel limestone of the Continent. The Calceola schiefer is found in South Devon; and the Stringocephalus Burtini of Combe Martin is so abundant in the Rhenish Devonians as to give its name to a limestone.

The Machinery of Politics and Proportional Representation. (Reprinted from "The American Law Review," January, 1872.)

Two Essays on Proportional Representation. By Mrs. Fawcett. (Reprinted by permission from "Macmillan's Magazine.") Published by the Representative Reform Association, 9, Buckingham Street, Strand, London. 1872.

We hope our readers will not be frightened at the idea of our adding politics to the list of matters to be dealt with in the Scientific Review by our noticing these pamphlets—we have work enough to do without such an addition—but the subject dealt with in these pamphlets is one of the most important that can well be imagined from an inventor's point of view. At present the claims of inventors to efficient and inexpensive legal recognition of property in their labours is, to use a common phrase, "nowhere", but by this means it would be possible for men who advocate their cause, and are otherwise fit men for a seat in the House of Commons, to gain entrance into that assembly The scheme is moreover a truly scientific one, originally developed by Mr. Thomas Hare, supported by Mr. Walter Morrison, M.P., and Mr. George Howell, men eminent in the ranks of advanced Liberals. It is thus summarised by Mrs. Fawcett —

1. All voters to be represented in Parliament.
2. Each member of Parliament to represent an equal number of voters.
3. Each elector to have one vote
4. Electors to be allowed to vote for any candidate.
5. Electors to be allowed to transfer their votes from one candidate to another, so that no votes are thrown away for candidates already elected, or for those who have no chance of obtaining the quota.

And those who wish to know more about the matter should read her pamphlet

The other pamphlet is perhaps more detailed, and we can commend it as an exhaustive treatment of the whole subject; for it reviews the various systems of voting, and shows that this one has been applied with success at recent elections by ballot of members of the Board of Overseers of Harvard College (U.S.)

Colour. (Cassell's Technical Manual Series) By A H Church, M A., of Lincoln College, Oxford, Professor of Chemistry in the Royal Agricultural College, Cirencester Cassell, Petter, and Galpin, London, Paris, and New York.

Those who want to be in possession of "quantum suff." of elementary knowledge of colour, and a good deal beyond what is elementary besides, should (unless they are already in possession of Cassell's Technical Educator) get this little work and study it.

Cassell's Technical Educator; an Encyclopædia of Technical Education. Vol. IV. Cassell, Petter, and Galpin, London, Paris, and New York.

We have in former pages expressed our favourable opinion of the preceding volumes of this work, and in now presenting to our readers this new one (which is fully equal to those previously published, and completes the series) we feel it incumbent on us to consider all the volumes together, as a whole work.

There can be no doubt that as a book of reference it will be found of great use to those persons who, without seeking to be adepts in the various arts and avocations therein treated of, find it desirable, from their trading connection with them, to possess a good acquaintanceship therewith; and, further, that some subjects are handled in a manner so definite and detailed, that artisans and others whose knowledge of the industry they practice is chiefly manual, will learn much as to the technic science appertaining to such branches of industry. Hence we are justified in recommending this work as a valuable addition to our general educational machinery, and an important aid to the advancement of knowledge in trade-science.

It may perhaps be expected in a work which deals with so many diverse matters that, whilst the treatment of some may be worthy of the highest praise, the handling of others may be entitled to some amount of blame. We can truly say that after due examination and consideration we can see little to disparage. The only point we find to be worthy of adverse criticism is the occasional use of *book-making* in the way of general disquisitions upon the present state and prosperity of an industry under consideration, and that these general and historical remarks are too much mixed up with the really technically instructive part of the essay—a not altogether trivial matter for practical men seeking for more knowledge, seeing they are compelled to wade through much that is either well-known to, or little cared for by, them. We are ready to believe, however, that this is only one of the results of the false system on which technical education seems likely to be proceeded with—namely, that those who teach technical science are not persons from the workshop who have added scientific knowledge to operative experience, but are men of science who have been mere bystanders in the workshop. It is said to be a growing opinion in politics that working men are the only reliable persons to assist the Government in dealing with the wants and wishes of working men in a satisfactory manner, and, whatever may be the real value of this as a political dogma, we hold a similar doctrine to be incontestably true as regards the efficient teaching of practical science.

Some subjects, too, are treated of which are scarcely within the range of technical education for instance, Patent Law and Trade-Mark Law have many pages bestowed upon them, well written enough it is true, whilst Bookkeeping, which has quite as good a right to find a place in the work, is discarded altogether.

In any future editions we would suggest, in the interest of technical students, that all collateral matters, such as the historical and legal portions of the work, be relegated to the last vol., which the student may purchase or not, as he may think fit.

Project of an Instrument for the Identification of Persons. for use in Military Establishments, Police Offices, &c., and for Physiological and Artistic Research. By Joseph Bonomi. London. Longmans, Green, & Co. 1872.

This project is a *curiosa technica*, and we cannot do better than let Mr. Bonomi speak for himself.

"Nature," he says, "in the construction of the human frame, has so ordained, that the measure of the distance from the extremity of one hand to the extremity of the other, when the arms are extended, should be the same as the measure from the top of the head to the sole of the foot." This proportional measure of the human figure, like all the others given by Vitruvius, is to be regarded as the normal proportion which the extended arms should bear to the entire height, for in some individuals the measure of the extended arms exceeds that of the height, while, in others, it falls short, and in others again, it exactly equals the height. From this fact it follows, that every individual of the human family must belong to one or other of three classes: for, either they must belong to that class in

which the measure of the extended arms exceeds the height; or, to the class in which the height exceeds the measure of the arms; or thirdly, to that class in which the measure of the extended arms is exactly equal to that of the height.

This law, then, of natural growth, which enables us to divide the human family into three distinct classes, is not only of great physiological interest, but is also of great social importance, because, as it will be shown, it may be made by a very simple apparatus to furnish the means for the identification of any adult person with a certainty that could not be obtained except by a careful scrutiny of the naked body.

With a view to illustrate the application of the instrument for measuring in the clearest and most comprehensive manner, two persons, as remarkable samples of growth, have been chosen and drawn in outline, in what an architect would call "geometrical elevation" that is to say, without perspective, and to scale, and in a way that permits of comparing by actual measurement one figure with the other. The smaller figure represents a dwarf, 3 feet 8 inches in height; the larger figure a giant, 8 feet in height. Both figures are represented in the position in which the person to be measured by the instrument is required to stand.

The two remarkable samples of growth here quoted are represented naked, in order that the comparison, in a scientific point of view, should be more exact than it could have been had the figures been clothed or represented in perspective. It is not, however, in the least necessary that persons to be measured by the instrument should be at all undressed, allowance being made for the depth of the heels of the boots.

In the space to the right is drawn to scale the indicators for ascertaining the height and extent of the arms. They slide down, and are maintained in the right position by means of the tongue of wood, which exactly fits the groove. The projecting flat part of the indicator, to measure the height, should not be less than five inches in width and nine inches in length. The indicator which is to measure the extent of the arms need not be so long, but it must be of the same width as that for the he[illegible].

The main part of the instrument consists of two laths of deal, fixed at certain angles against a wall. Down the centre of each lath is a groove in which slides an indicator. The indicator which is to measure the height is brought down to touch the top of the head, and that which is to measure the extent of the arms is made to touch the extremity of the middle finger of one hand, while the extremity of the middle finger of the other touches an upright strip of wood or an angle of the room in which the instrument is fixed.

Thus, by the simple movement of the indicators, both the height and extent of the arms are almost simultaneously ascertained, the two inclined laths being divided into feet, inches, and eighths of an inch, in order to secure the greatest possible accuracy.

The mode of obtaining the proper inclination of the two laths Mr Bonomi explains by reference to a diagram, and he afterwards describes the method of recording the measurement, and adds:—

Statement of the analysis of the measurements of the height and extension of the arms of 84 persons taken with the instrument by the Author.

In the 84 persons, male and female, there were—

54 long armed,
24 short armed, and
6 whose extended arms were exactly
— equal to their height.
84

54, 24, 6, being in the ratio of the squares of 3, 2, and 1

The greatest excess of length of arms was in the case of a carpenter, whose arms exceeded his height by five inches. The greatest excess of height over the extended arms was four inches, and that was in the case of an architect.

In the 84 persons there were not two in whom the measures of height and extent of arms were alike—that is to say, that though there were six persons of whom the length of the extended arms was the same as the height, yet, of those six, not two were of the same height.

This shilling pamphlet of 12 pages embellished with appropriate illustrations is, after all, highly interesting, and worthy of attention by all our public departments which require to identify persons, and, indeed, by all persons interested in physiological researches.

New Theory of Galvanism:—The Electro-thermology of Chemistry, Electricity, and Heat Phases of the same principle. By Thomas Wright Hall, M.D., L.R.C.S.E. Edinburgh,· Edmonston & Douglas, 1872.

This is a very interesting and instructive treatise on an important subject, for as the author appositely observes –

Heat is held the fundamental cause of most of the beautiful, complex, and enigmatical phenomena of chemistry.

Heat is considered to be as closely kin to electricity as is infancy to manhood, and thus to be all-worthy of scientific apotheosis.

Our author goes on to state the *raison d'être* of this treatise thus:—

To one viewing heat in such novel aspects, it is clear that new ideas must have occurred, and, consequently, new words, to express these ideas, became indispensable; and I am indebted to Professor P. G. Tait, of Edinburgh, for his valuable suggestion of the word "thermic," to express certain conditions of heat supposed by me to exist in chemicals. In addition to "thermic," I have been forced to use, throughout this essay, several other new terms. I am aware that these new words may sound uncouth, but their absolute necessity for the intelligible explanation of my views, will, I hope, excuse their employment, and in a measure disarm stringent criticism I may farther state, as an apology for having published at all these ideas about heat, that no other better way of testing whether these ideas were true or false could be found.

Dr. Hall's treatment of this important subject he thus introduces to the public —

If powdered antimony be thrown into chlorine gas, the chemical action between these two substances is so strong that the antimony at once takes fire and burns brightly into the terchloride of antimony. But if, according to Schrotter (*Chimie*, vol i. p 129), the antimony and the chlorine be both cooled down to minus 106° by a bath of solid carbonic acid and ether, then the chlorine and antimony, thus cooled, refuse to combine chemically, and remain in intimate contact as passively as if they were sand and common air. Again, if antimony be exposed to dry or moist air for any length of time, antimony remains unaffected chemically by the air, and if the self-same antimony be *heated* in the self-same air, the heated antimony at once combines with the air, takes fire, oxidises, burns into the teroxide of antimony.

The simplest of chemical experiments are not the least suggestive, and prove the great fact that heat exerts the following most remarkable influences on chemical action.—

Heat, that is change of temperature, may nullify or prevent chemical action, though that action be of the most violent nature.

Heat, or change of temperature, may intensify chemical action, though of the weakest kind.

That is, simple changes of temperature alone, certain determinate states of heat may destroy or may create, *pro tempore*, chemical action. Now this is surely very suggestive, for if the above simple and artificial states of heat in the bodies prove so potent in chemistry, it at once occurs to the mind to ask, What effect shall the much more perfect natural states of heat, that is heat properties of chemicals, have on their chemical behaviours? and in order to answer that question we proceed to study what I shall venture to call "Thermochemics," that is, the consideration of heat as a specialty in chemistry.

The most prominent heat states or heat properties of chemicals are their conditional heat, their specific heat, their weight heat, and their conduction of heat.

If we examine the condition of chemicals, say for convenience and perspicuity, those of the metals and metalloid oxygen, we find those conditions very varied and very different one from another. One metal, hydrogen, exists as an unliquefied gas, that is a gas far from liquidity, far from *a form change*.

Another metal, mercury, is a liquid.

Another metal, potassium, is a solid, but a solid that is near liquidity—that is, that is easily fused, that is near to a form change.

Another metal, zinc, is a solid, but a solid not so near liquidity, not so fusible, not so near a form change as is potassium.

Lastly, another metal, platinum is a solid, and a solid very far from liquidity, very difficult of fusion, very far from a form change.

Now it seems to me impossible to doubt that heat must have a direct and necessary influence in causing these wide differences in the physical condition or forms of the above mentioned metals For let us take the two metals hydrogen and platinum, and contrast them thermally.

Hydrogen is an unliquefied gas.

Platinum is a well nigh infusible solid.

Now it seems to me utterly impossible to conceive or suppose that gaseous hydrogen and infusible platinum can have equal heatfulness, can have the self-same amount of heat in their ultimate molecules, for hydrogen is as it were many times more thermic or heatful than the hottest of steams, and platinum many times more athermic or heatless than the coldest of ice. Hydrogen being an exceedingly rarefied gas, it seems presumable that in hydrogen there should exist much more latent heat than in the infusible solid platinum; and if it be so, then hydrogen is what I shall throughout this paper call conditionally more thermic than platinum; and not only that, but for a like analogous reason, the metal mercury shall be more thermic conditionally than the metal potassium. Because mercury, being liquid, is thus nearer the hot gaseous state than is potassium, which happens to be a solid And for the same reason potassium shall be more thermic conditionally than zinc, inasmuch as potassium is nearer the hotter form of liquidity,—is much more fusible than zinc. And further for the same reason, zinc shall be conditionally more thermic than platinum, for zinc is much more fusible than platinum

I do not mean to say that the above-mentioned metals are one hotter or colder than another in such a way as to affect our feelings or touch, or even the more trustworthy thermometer; but what I assert is that the said metals are, some latently conditionally thermic, as I shall term it, and others latently conditionally athermic I must beg it as an axiom if it cannot be granted otherwise, that *any* metal that is a gas is to be considered conditionally more thermic than any given metal that is a liquid; and in further extension of the axiom, *that any given metal that is a liquid* is to be held what I have called conditionally more thermic than any given metal that is solid; and moreover, that any given metal that is solid, and fuses with ease, being thus near liquidity, is more thermic or heatful conditionally than any given metal that is solid, and is far from its fusion, or fuses with less ease.

The physical states or conditions of gaseity, liquefiability, liquidity, solidity, fusibility, in which metals are found in nature, prove thus the indication of their states of conditional heat.

But the second of our great heat properties of metals is their capacity for heat. And surely if heat has to play important parts in

chemistry, the capacity for heat in chemicals must be of the greatest importance in chemistry. And so it proves, for the capacity for heat in metals bears a marked proportion to their atomic weights—is the same, with a few exceptions, with these atomic weights. So that an equal heat that will raise 65 grains of zinc 10° in six minutes, will in, the same time and conditions raise not 65 grains of platinum, but 197 grains, and 200 grains of mercury, and 39 of potassium, and so on.

So that zinc and potassium have far more power of appropriating heat, of taking quantities of heat and stowing it away in a latent state in their ultimate textures, than platinum has, for 65 grains of zinc and 39 of potassium will swallow up as much heat as 197 grains of platinum. After say six minutes' heating of zinc, potassium, and platinum, there will exist much more concentrated heat, latent in potassium and zinc than in platinum.

We will therefore assume it is an axiom that the less the atomic weight a metal has, the greater its heat capacities; the more thermic or heatful atomically, as I shall term it, the metal generally is.

So that of all the fore-mentioned metals hydrogen is atomically most thermic, because hydrogen's atomic weight is 1, the smallest atomic weight among chemicals. Next to hydrogen in the said metals comes potassium, for potassium's capacity for heat is as 39; after potassium comes zinc, whose capacity for heat is as 65; then platinum, which is as 197; then last of all is mercury, which is as 200, and which is thus the coldest atomed metal in our short list.

So that the capacity for heat of simple bodies, or, what is nearly the same thing, their atomic weights, afford also a most valuable indication of the atomical heat states of simple metals.

But the third great heat properties of metals is what I shall term their weight heat, their mass heat, their grain heat; for just as heat influences a metal's expansion, so heat influences a metal's specific gravity; and just as a metal's expansion has been taken and used as a heat indicator, I propose that a metal's specific gravity be used as a special heat index, as a chemical thermometer; and as the effect of heat is to make metals lighter, I will assume it is axiomatic that the lighter a metal is the hotter grained it is.

Thus, of the already-mentioned metals, hydrogen is the hottest grained, inasmuch as hydrogen is the lightest of them. Next to hydrogen comes potassium, for potassium is certainly heavier than hydrogen, and lighter than all the others of the said metals. After potassium comes zinc, then mercury, and last platinum.

Our fourth great heat property of metals is their conduction of heat, and this must be held also of extreme importance, for it is clear that, whatever be the influence and effects of heat in chemical action, conduction of heat in a chemical must facilitate those heat actions, as non-conduction of heat must impede them.

So that there are, at *least*, three ways in which a metal can be chemically thermic or athermic, heatful or heatless—by *condition*, by *specific heat*, and by *weight*. Some metals, as hydrogen and potassium, are heatful by all these three tests; and these metals are therefore types, or our beau ideals, of chemically thermic metals,—are very thermic, calorous, heatful indeed, very positive or plus as to heat, for they are hot conditioned, hot grained, and hot atomed. Some metals, on the contrary, such as platinum, are athermic by all these three tests, and are therefore our beau-ideals of chemically athermic or heatless, or non-calorous metals, and are very athermic indeed, very negative or minus as to heat, for they are cold conditioned, cold grained, and cold atomed. Mercury is, however, very thermic conditionally, but so athermic atomed and grained that mercury ranks more as an athermic or heat negative metal than as a thermic one, for mercury is very heavy and has very low specific heat. The heat properties of mercury counterbalance each other, not an unusual occurrence in chemistry.

In the simple experiments with which we began this paper, the changes of temperature to which antimony and chlorine were subjected by Schrotter were wholly artificial. But if we apply our axioms and rules just enumerated, we find that nature has made for us analogous experiments, for nature has cooled down platinum in a bath many times colder than that of the solid carbonic acid and ether, and heated up hydrogen in furnaces far hotter than any made with hands, and with analogous chemical results to those produced by the cooling or heating of puny art. For chemically thermic potassium and thermic hydrogen have most violent chemical activity, and the very chemically athermic platinum is one of the most inactive of chemicals; while irregularly thermic and athermic mercury presents chemical actions corresponding to such unsymmetric heat properties.

The author continues the consideration of heat in regard to metals, whether chemically thermic, thermally irregular metals, with hints of chemical heat on chemical behaviour.

In the second chapter Dr. Hall discusses conditional heat changes or discharges during chemical binary combination, heat discharged from or into both combiners, when discharged from one combiner to the other; such conditional heat discharges, like electric discharges, leading to a heat equilibrium, the reverse heat changes during binary decompositions and heat metallicity.

In the next chapter we have heat considered as a great cause of form change in nature turning visible ice into invisible steam; and heat is shown to be the cause of the allotropies of chemicals, and of form change of chemicals, also that chemical compounds are a mixture of allotropies or glowshapes of their ingredients.

(*Continued on page 13.*)

THE SUGAR MANUFACTURE IN EGYPT.

At a recent meeting of the Institution of Civil Engineers a paper was read "On the Aba-el-Wakf Sugar Factory in Upper Egypt," by Mr. W. Anderson, M. Inst. C.E. A narrative was first given of the manner in which Mr. J. Easton, M. Inst. C.E., had been invited by H. H. the Khedive to report on his sugar estates, and the consequent ordering of the factory that formed the subject of this communication. The position of Aba was described as 120 miles south of Cairo and about two miles west of the Nile. A general sketch followed of the ordinary methods of converting cane-juice into sugar, clarified by lime only, or with the bi-sulphite of lime also, concentrating in the rudest manner in open pans and concretors, or, as at Bene Mazar, a neighbouring factory erected by Messrs. Eastons and Anderson, in the more perfect double and treble action tubular concentrators working in vacuo, with filtration of juice and syrup through animal charcoal, granulating at the atmospheric pressure, or in vacuo, and curing by *centrifugal machines*.

The immediate subject of the paper was divided into three parts. 1 A general description of the process of manufacture. 2. A detailed description of some of the machinery designed expressly for the new process. 3 An investigation of the chemistry and physics of the manufacture. It was mentioned that Mr. G. Ogston, analytical chemist, had carried out all the necessary chemical investigations before the new process was adopted, and had subsequently visited Aba and determined the percentages of various sugars produced.

Under the first head, it was explained how the juice delivered from the cane mills was raised by a centrifugal pump into the steam clarifiers, was then caused to boil, treated with sulphurous acid gas, neutralised by milk of lime, run down into subsiders, decanted when clear, and passed through steam concentrators, from which the syrup flowed into tanks, whence it was sucked up into the vacuum pans, boiled to grain and let down into waggons. The sugar was next emptied into coolers, was thence passed through mixing mills, and was finally cured in centrifugal machines. The scum from the clarification was placed in hydraulic presses to separate the juice carried away by it. The steam generated from the juice was collected under 3 lbs. to 6 lbs. pressure, and was used to boil the vacuum pans, and to work the steam engines driving the vacuum and water pumps, centrifugal machines, and mechanics' shop.

Under the second head, the four cane mills were minutely described. They were of the three-roller class, with rolls 48 inches in diameter, 5 feet 6 inches long, and driven in a manner totally different from anything hitherto attempted. The main features of the new system of gearing were that the mill pinions were nearly double the diameter of the rolls, that the power was distributed through a larger number of pinions so as to permit a greatly increased width of bearing face on the teeth, and that alterations in the set of the rolls did not affect the working of the wheels. The cane mills were actuated by double cylinder condensing, or Wolff beam engines, with reversing motions, and supplied with steam by four Cornish multitubular boilers. Indicator diagrams taken off the engines, and the known evaporative powers of the boilers, were shown to agree in assigning 68 indicated horse power to each set of crushing machinery.

The raw juice tank with its double set of strainers, the centrifugal juice pumps and engines, and the sulphurous acid producing apparatus and pumps, were next described. The twelve clarifiers with copper bottoms and steam jackets held 450 gallons each, and were heated by steam at a pressure of 60 lbs. Experiments had been made on them, and they were found to transmit, per difference of 1° of temperature per square foot of heating surface per hour, 200 and 219 units of heat in warming water and juice respectively, and 606 and 521 units in evaporating.

The subsiders, twelve in number, were plain cast-iron tanks of the same capacity as the clarifiers. They are fitted with sliding Appold overflows for decanting, and with scum and wash-out valves. The scum and subsidence were collected in two tanks, from which, by means of hose, they were run into bags placed in two hydraulic presses. These had inverted cylinders, were double acting, and were worked by the ordinary water supply of the factory, giving a total pressure of 2½ tons, which was found to be sufficient to separate the juice from the solid scum.

The clarified juice at about 160° temperature was concentrated in five trays of novel construction. The lower part of each tray consisted of a steam boiler, 23 feet by 6 feet by 12½ inches deep, from the bottom of which hung 467 water pipes with internal circulating tubes, the whole set over a suitable furnace. The upper plate of the boiler formed a copper tray 6 inches deep, the surface augmented by 495 brass nozzles, and covered in by a semi-circular sheet-iron dome for the purpose of collecting the steam generated from the juice, which in flowing over the tray lost 57 per cent. of its volume, and was concentrated from 10° to 21° Beaumé. Experiments made with one of the trays at the Frith Ironworks were found to give 271 units of heat in warming and 491 units in evaporating water per difference of 1° per square foot of surface per hour, and a capacity of evaporation equal to 148 H. P.

The four boilers supplying high-pressure steam to the clarifiers and centrifugal machines were of 50 H. P. each, and were externally fired for the convenience of burning megass. They were fed chiefly by the condensed steam from the clarifiers, and could be supplemented by the cane mill boilers when required, by means of a connecting steam pipe.

The five vacuum pans were each 10 feet in diameter and 9 feet 6 inches high, of [illegible] cubic feet capacity, and were worked by the steam generated from the juice in the con-

centrators. The vacuum pumps, four in number, were each 28 inches in diameter with a length of stroke of 1 foot 10½ inches, and were arranged under the beams of a pair of condensing engines having cylinders 28 inches in diameter with a length of stroke of 5 feet; they were supplied with steam at a pressure of 3 lbs., also from the concentrators. A similar pair of engines, supplied with steam from the same source, drove the main lay shaft which actuated the mechanics' shop and the centrifugal curing machines. These engines had indicated 28 and 80 horse power respectively. The coolers and crystallizers were all of cast-iron with external flanges. The centrifugal machines had baskets, 30 inches by 11 inches, and were driven under the floor of the curing-house, in groups of six, from countershafts actuated by the main lay shaft, each machine being put in motion, or stopped, by hand gear attached to its casing.

The buildings of the factory consisted of a wrought-iron skeleton, composed of girder-shaped columns, placed 20 feet apart, and connected by arched roof rafters, on which were laid iron purlins and corrugated galvanised roofing. The intervals between the pillars were filled in with 12-inch brickwork, into which iron windows and doors were introduced as required. Travelling cranes on overhead rails ran over the cane mills and vacuum engines. The dimensions over all were 481 feet 6 inches by 155 feet, and 38 feet high, with a total area of 45,162 square feet.

The water supply was derived from the Ibrahimia Canal, the engines and vacuum pans drawing their own injection, while the high service was supplied by double acting pumps on the centrifugals' engines, which raised the water into a tank, having a capacity of 14,000 gallons, placed on the top of a water tower 42 feet high. The factory was lighted by gas produced in a small gas works of 250 lights near the mill.

Under the third head the property of sulphurous acid gas in bleaching and arresting fermentation was alluded to. Its use for sugar making had been patented as early as 1838, and many times afterwards, but although very economical as regards cost, it had met with little favour, the reasons for which were given. The success of the Aba Factory was traced to the circumstance that it was the first constructed expressly for the use of sulphurous acid combined with extremely rapid concentration. The quantity of sulphur and lime used, the latter as compared with the neighbouring factory of Bene Mazar, was then examined, and a comparison of the new and old, but hitherto most perfect system of manufacture, showed that the raw juice was converted into syrup in 2 hours at Aba, against 6 hours at Bene Mazar

Mr. Ogston's experiments to ascertain the yield of sugar were then described, and the results contrasted with those of factories in Demerara in New South Wales, showing that under the new system there was a much larger return of first white sugars, and a much smaller yield of molasses than in other methods of manufacture.

Interesting investigations were then made as to the degree of concentration necessary in the evaporators to supply steam enough to boil the vacuum pans and to furnish the power required for curing It was shown that by evaporating 57 per cent. of the juice the desired results should be, and actually had been, obtained. The total power necessary to work the mill was then computed, and, taking into account the work done by the steam from the juice, it was shown that there remained 20 lbs. of dry megass available for the evaporation of every cubic foot of water. The efficiency of megass was shown to be about one-half that of coal, and it was argued that by the new system the manufacture might be carried on without the aid of coal at all. The cost of the mill was then dwelt upon, and contrasted with that of Bene Mazar, showing that there was a saving in capital outlay of 23 per cent. on machinery, and about 11 per cent. for stock of animal charcoal, besides the heavy annual charge for revivifying the latter and supplying the loss by waste. In conclusion it was claimed that on the score of high yield of first sugars, small percentage of molasses, economy of fuel, simplicity of manufacture, and lowness of first cost of machinery, the new process of sugar making promised to become a substantial success.

Acknowledgments were made for the gracious manner in which his highness the Khedive had given permission for the preparation of the paper, for the assistance rendered by Mr. H D. Anderson, Assoc. Inst. C E., Engineer-in-Chief of the Paper Mill in Cairo, and the Sugar Factories of Aba Bene Mazar, and Malatea, and for the services of the Resident Engineer of Aba-el-Wakf, Mr. Cheesman, Stud. Inst. C.E., under whom it had been erected and put to work.

NEW PATENT LAW IN JAPAN.

(Communicated by Her Majesty's Secretary of State for Foreign Affairs, May 25, 1871.)

HENCEFORWARD exclusive permission to trade in newly-invented articles of all kinds whatsoever will be granted to the inventors.

Patents shall be granted for a term of years to all persons who increase the conveniences of life, who newly invent any chemical apparatus, machinery, utensils, or furniture, weapons, woven fabrics, et cetera, or who improve existing furniture or utensils.

The term of years shall be fifteen years, ten years, or seven years, according to the value of the invention

Any person desirous of obtaining a patent shall send in his application to the local authorities of the district in which he resides, accompanied by a description, drawings, &c., which shall be forwarded to the Home Office, and the Home Office shall issue the patent.

The objects of the invention or the improvement shall be carefully drawn in cross-section and plan, and in the case of machinery the parts must be numbered or lettered in accordance with the description, so that everything may be clearly comprehensible at a single glance; and the seals of the inventor and of his surety must be attached to the drawings. Models may be furnished of articles of which drawings cannot easily be made.

When the document containing the patent is issued by the Home Office the local authorities shall deliver it, after having obtained a receipt from the inventor and his surety.

A duty of five rio (£1 1s. 3d.) shall be paid annually in advance during the period for which the patent is granted into the hands of the local authorities.

The duty may be increased or diminished, according to the nature of the invention. The amount shall be forwarded to the Home Department as soon as it is collected.

No duty shall be paid until six months have elapsed from the granting of the patent, that period being allowed for the inventor to try whether the sale be remunerative, and when he has ascertained that it is remunerative he will pay in one year's duty to the local authorities.

If from the trial made during the first six months the sale turns out to be unremunerative, the application may be withdrawn at the option of the patentee; but in case such application be made after the expiration of the six months, the duty for one year already paid in advance will not be returned.

The application sent into the Home Office will receive consideration according to priority of arrival.

Where the invention of another has simply been improved, the application must distinctly state the name of the original inventor and the nature of the improvement. Where the invention in respect of which an application is made resembles a prior invention by another individual, but actually differs in construction or use, the points of difference must be clearly laid down in the application.

No patent will be granted for articles of general convenience, though the inventor be known beyond the possibility of mistake, and be yet alive, if the invention has been in general use for several years previous to the application.

Separate patents will not be given to each individual who may have combined with others to produce an invention, but a single patent will be issued in the name of all the partners of the company.

The owner of a patent may freely dispose of it for such sum as seems fit, during the period for which it has been granted; and both parties shall make application to have the fact endorsed upon the patent.

The patentee is at liberty to establish branch shops in his own name, or to teach others how to make the articles patented by him.

Should the patentee die before the patent expires, he may leave the patent to a relation, but application must be made to have the transfer endorsed thereon.

Extensions may be granted in meritorious cases.

Each separate article must bear the words "by Government sanction," together with the name of the inventor.

Fines will be imposed on persons who fraudently make use of a patentee's name, or who, not being in the enjoyment of a patent, make use of the term "by Government sanction."—*From the Journal of Her Majesty's Commissioners of Patents.*

BALL LIGHTNING.

A CORRESPONDENT (says the *Scientific American*) was surprised at the letter of J. H. P., published in a recent number, and states that in 1859 in the Shetucket valley, Conn., he had a view of a stroke of this kind of lightning at about eight rods distance. It struck a tree, rent it from top to bottom, passed off to a cart tongue lying near, into and through a pile of railroad ties, and into the railroad track about two rods distance. It was seen by six other persons, and the size, as it appeared to all, seemed to be as large as a bushel basket They were in a building on a rise of ground facing the tree, and had a most perfect view of it. Undoutedly there are a good many in the United States who have seen such strokes, if they would take the trouble to answer.

THE SUN AND THE ORIGIN OF STORMS.

MR. JOHN HEPBURN says, "I have seen that all gusts coming up in the morning come from eastward, all about noon from the southward, and all after sunset from the westward; thus clearly proving, to my mind, that the rays of the sun drive the storm, as it were, away from him after their electricity has fired and lit it up. Let the interested please observe and they will find it so, I believe, in all cases."

A SIMPLE HYGROMETER.

A NEW hygrometer has been invented by M. G. Smiths, of Paris, in which a salt of cobalt is the essential ingredient. A solution is made of the salt of cobalt, common salt, and gum arabic; into this strips of paper are dipped, and allowed to dry. They will take on a blue colour in a dry atmosphere, and become rose-coloured if the atmosphere be humid.

CONCENTRATING SULPHURIC ACID TO 66° BAUME.

M. DE HEMPTINNE proposes to use a lead-lined vacuum pan for this purpose. The lead is not sensibly attacked by the acid unless the temperature is 200° or over, while in air the sulphuric acid will not boil except at 325°; in the partial vacuum of the pan, 3 to 4 centimetres of mercury, it will readily boil at 190°. The lead, however, softens at this temperature, and is subjected to a considerable pressure from without; and to avoid this difficulty it is proposed to place in the pan sandstone balls, &c., which are not attacked by the acid.

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LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES.

THURSDAY, JANUARY 16TH, at Eight o'clock p.m., Adjourned Meeting on Patent Law Reform.

THURSDAY, JANUARY 30TH, at Eight o'clock p.m., a Paper will be read on "An Invention for preventing pipes or vessels bursting by the effects of frost." By J. A. CALANTARIENTS, Esq.

Members whose subscriptions are now due will please to forward the same to the Collector, Mr G. A. Stretton, 4, St Martin's Place, Trafalgar Square, London

Monthly Notices.

Tribunals of Commerce.—Death of Mrs. Somerville.—Salaries of Scientific Men in the Public Service.—Patent Law for Japan.—Mr. J. M. Joannides' new Invention for Ventilating and Drying Cotton Bales.

THE subject of Tribunals of Commerce is again before the public, a busybody clique in the Common Council of the City of London having, it appears, determined to promote a Bill for establishing such an institution in the City; but, as might be expected from the acting of such a mere local sectional body, the proposed Bill is not intended to effect the establishment of a tribunal composed of commercial men and industrials as its adjudicators, but is to be a brand-new law-court, with a lawyer, judge, and a few old fogies as commercial assessors, duly assisted by barristers and solicitors. In fact, it is a new scheme for creating places for lawyers, and further complicating our legal system. As we want to see a *bona fide* tribunal for dealing out real justice, and not for administering mere law, and which shall be applicable to the case of inventors and patentees, and competent to deal with questions of trade-mark and copyright, we feel annoyed that such a *travestie* should be attempted to be palmed off upon the public. How is it that the Lord Mayor, who is well known to commerce and manufactures, and is the head of all the Guilds, whose members are many of them men of eminence in commerce and manufactures, cannot assemble them together and get something like a worthy scheme propounded for public consideration? And what has become of our friend J. R. TAYLOR, who was moving in this matter not long ago?

Mrs. Somerville died recently at Naples, at the advanced age of nearly ninety-two years. She was a contemporary of Sir David Brewster—indeed, we believe that in childhood he was her playmate. Her works and merits are so widely known in the world of science that it is unnecessary for us to recapitulate them.

The trumpery salaries of scientific men occupied in our public service are a standing disgrace to this country, and we cannot refrain from quoting from the *Athenæum* the following pertinent remarks, signed "F. R. S.," referring to this matter, for they are thoroughly in accord with the views we have often expressed. In the communication referred to, "F. R. S." says:—

"The Civil Service Commissioners are advertising for a clerk for the Curator of the Gardens, and a second assistant in the Herbarium of Kew Gardens, to be selected by open competition. The former must be 'familiar with gardening and gardening accounts.' The second is to 'show from previous training that he possesses sufficient skill in the dealing with Herbarium specimens, in the use of the microscope, and in discriminating between species and varieties of plants.' The gardener's clerk, who is only required to have qualifications common to many English and most Scotch gardeners, is to have a salary of £100 a-year, rising to £200. The young scientific botantist, who is expected to be skilful in one of the most abstruse subjects of botanical science, viz., the 'discrimination between species and varieties of plants,' a subject upon which the most experienced and the most scientific botanists do not agree, is to have a salary of £60, rising to £100! The wording of the qualifications required is scarcely such as ought to be put forth by the Civil Service Commissioners, as the decision as to the qualifications and judgment of the candidate would depend upon which of the two sections of botanists the examiner belongs to, whether he is what is known in technical language as a 'lumper' or a 'splitter'; for the reply that one would consider good, and accept, the other would consider bad, and reject. Thus, for example, if Mr. Bentham and Mr Miers, gentlemen who have studied and written on the species of plants for more than a third of a century, were asked to define the discrimination between species and varieties of plants, their replies would be as far as the poles asunder."

The Japanese have lately given practical proof that they are no disciples of Mr. Marfio and our saintly Lord Chancellor, for they have promulgated a Patent Law, an abridgment of which will be found in another column.

Our friend Mr. J. M. Joannides, whose invention for ventilating and drying corn in ships, granaries, &c., was noticed in our pages not long ago, has called our attention to a somewhat similar invention of his for the ventilation of cochineal boxes, which is also applicable to the ventilation of cotton bales. It has been most successfully adopted in cochineal boxes, and recent experiments promise well for it in regard to cotton bales. We shall hereafter refer to this matter, and supply our readers with full details; if, in the meantime, they would like to know more about the matter, they can apply to Messrs. Adutt, Finzi, & Co., 24, Mark Lane, London, E.C.

The Inventors' Institute.

AT the first Members' Meeting of the Session 1872-73, held on Thursday, the 21st November, 1872, in consequence of the unavoidable absence of the Chairman of the Council, Sir ANTONIO BRADY, the chair was taken by Mr. F. W. CAMPIN, Barrister-at-Law, member of the Council of the Institute, who stated that he must solicit the indulgence of the meeting, as he had had but little time for preparing himself for his task. He then said:—It has been the custom in this, as in other kindred associations, that upon commencing a new session the work that had been accomplished in the last session should be passed in review, and the business for the opening session laid before its members. With regard to the last session, he thought everyone connected with the Institute would feel that it had been on the whole a great success. As they were most of them aware, the acceptance of Sir Antonio Brady of the Chairmanship of Council was deemed a fitting occasion for inaugurating the last session by a public dinner, which took place at St. James's Hall on 30th November 1871, the proceedings at which (duly reported in the SCIENTIFIC REVIEW), as also at the opening meeting, held the same day at the usual meeting place of the Institute, 4 St. Martin's Lane, Trafalgar Square, were of the most pleasant and satisfactory character, so much so, indeed, that it has been urged by some members of the Institute that such friendly gatherings should be oftener indulged in by its members. But the Institute, although it has given attention to these amenities of life, has not the less been attentive to its more serious duties, the first matter it undertook to deal with being the very important one of technical education, a subject that he (the Chairman) had more than once brought under the notice of the members, especially in regard to its connection with the Civic Guilds. In the movement in this matter the Council were fortunate enough to obtain the co-operation of Mr. John Scott Russell, and under his presidency were held several meetings of delegates from the Technical University, Artisans' Associations, and other bodies, which eventuated in the adoption of resolutions detailed in the SCIENTIFIC REVIEW for January and May, 1872. However, in deference to the views of some of its leading members, the Council determined to refer all further proceedings on technical education to the committee that had been formed, and to leave it to act as a distinct body, under the presidency of Sir Antonio Brady, which was accordingly done, and the proceedings of that committee will be found reported in the SCIENTIFIC REVIEW for January and February of the present year, which also contains a report of the reading of a paper by Dr. Mill, of the Technical University. The next subject that engaged the attention of the Institute was one introduced to the notice of its members by a paper (*vide* SCIENTIFIC REVIEW) read by Mr. B. Fletcher, M.I.B.A., "On Inventions and Patents connected with Building," which led to a very animated discussion, which was adjourned to a second night, and received a large share of attention from the general public, as evidenced by the favourable reports given by the public press. "The Purchase of Railways by the State," by Mr. Raphael Brandon, F.R.I.B.A., was another important matter introduced to the notice of our members by a paper read at one of our fortnightly meetings. The important subject of preserving corn, grain, and other substances from mildew in ships, granaries, and stores, by means of a ventilating apparatus invented by Mr. J. M. Joannides, formed the subject of an able paper read by Mr. L. M. Adutt, which led to an interesting discussion demonstrating the invention to be one of considerable promise of practical value. Mr. J. R. Varley's paper on inventions relating to telegraphy also deserves special mention, for it was a masterly dissertation on the principal means adopted in telegraphy, comprising some suggestions as to important improvements. At some of the meetings of the Institute a lamp burning a new composite oil or liquid, which gave a clear, brilliant light, equal to seventeen sperm candles, was exhibited by Mr. C. C. Molchin, which was produced at a cost somewhat greater than paraffin, and satisfied all present that a valuable addition had been made to our lighting *media*. The Patent Laws have also formed the subject of consideration and discussion at several meetings of the Institute, and complaints as to their many defects have been as numerous and emphatic as ever. The Council, however, has not been content to allow Patent Law Reform to be treated simply as a matter to be talked over, but have taken such measures as were available to them for bringing out some practical results from the long and earnest labours of the Institute in this, the foremost of the objects of its programme. Our members will remember that in 1871 Mr. Bernard Samuelson, M.P., Mr. Mundella, M.P., and Mr. Hinde Palmer, M.P., pressed for and obtained the appointment by the House of Commons of a Select Committee of Inquiry into the subject of the law and practice of Letters Patent for Inventions, which sat till nearly the end of the session of 1871, and issued a first report in the autumn of that year, the proceedings of which committee were deemed to be anything but satisfactory, and have been much criticised in the pages of the SCIENTIFIC REVIEW. This committee was re-appointed at the commencement of the session 1872; the names of myself and other members of the Institute were suggested to the committee as competent witnesses on its behalf, and before that committee closed its evidence they did examine me, but refused, on the ground of want of time, to allow me to speak sufficiently at large to enable our case to be properly developed. The Council of the Institute, therefore, came to the conclusion that a movement should be made to obtain a fuller and more impartial inquiry into the whole question of the Patent Laws by means of a Royal Commission, to be composed principally of eminent inventors and patentees, but the session was too far gone to effect anything in the matter; therefore this remains as business now in hand.

Mr. CAMPIN added:—Gentlemen, I have thus reviewed our past proceedings, and therefore will now speak of our future policy by saying that the Council will continue to fight for Patent Law Reform of the most complete kind, and moreover will spare no pains to render the proceedings of the Institute as pleasant and profitable to all as they possibly can be made.

After some general remarks by members present at the meeting,

Mr. THOMAS BLANCHETT proposed a vote of thanks to the Chairman, and in doing so took the opportunity of stating that he considered the present state of the law of patents as highly oppressive. He himself had invented an apparatus for exhibiting withinside railway and other passenger carriages the name of the station at which it was stopping or about to stop at, and he found that the expense and loss of time involved in bringing this invention into practical form was very considerable, and he knew that his position in this respect was by no means peculiar to himself, nor was the fact that this expense, when added to the somewhat considerable charges for the patent, were to men of small pecuniary means almost sufficient to break them down altogether. Moreover, the difficulty and expense of patent law suits were, as a matter within his own business knowledge, most outrageous.

Mr. REGAN, in seconding this motion, mentioned that he considered the Institute would do well to make an effort to get inventors placed on a better footing when dealing with the Government. He was now treating with the Government department for the introduction of his furnace improvements into the public service, and he found that after the heads of the department had decided in his favour, he had afterwards to be subject to vexatious opposition from underlings in that department.

Mr. LATHAM explained that the Council were only too happy to receive any hints or suggestions for improving the Patent Laws, and he could assure the gentlemen who had spoken that the Council would do all they could to remedy the evils they had referred to.

The vote of thanks having been put, was carried unanimously, and the Chairman having briefly returned thanks, the meeting closed.

ON Thursday, 5th December, the paper read was on "Trade Guilds as promoters of Invention and Technical Education." At this meeting the chair was taken by Mr. FAULDING, Member of Council, and Messrs. Campin, Carlton, and Morgan took part in the proceedings. The report of this meeting, as also of the meeting on 19th December, is reserved till next month.

Proceedings of Societies.

INSTITUTION OF CIVIL ENGINEERS

AT the meeting on 26th November, Mr. Hawksley, president, in the chair, the paper was "On the Aba-el-Wakf Sugar Factory in Upper Egypt," by Mr. W. Anderson, M. Inst. C.E. This paper will be found in another column.

At the meeting of this society on Tuesday, the 3rd December, Mr. Hawksley, president, in the chair, the first ballot for the session 1872-73 was taken, when forty-seven candidates were balloted for and declared to be duly elected, including five members—viz., Messrs. Robert Edward Forrest, ex. eng., P.W.D., Government of India; Mr. William Hall, ex. eng., P.W.D., Government of India; Mr. John Skardon Heyman, ex. eng., P.W.D., Government of India; Mr. Robert Morton, chief engineer to the London Gas Company; and Mr. Henry Robert Waring, La Peubla, Majorca. Forty-two gentlemen were elected associates—viz., Mr. Samuel Abbott, assistant engineer, Great Northern Railway; Mr. John Addy, Stud. Inst. C.E., resident engineer, Hornsey Drainage Works; Mr. John Aiton, Iron Works, Holytown, Glasgow; Mr. John Romilly Allen, late assistant engineer at the Liverpool Docks; Mr. Crawford Peter Barlow, B.A., Stud Inst. C.E., Westminster; Mr. William Adamson Barron, Westminster; Mr. George John Burke, assistant engineer, P.W.D. Government of India; Mr. John Montriou Campion, Stud. Inst. C.E., assistant engineer, Punjaub Northern (State) Railway; Mr. William Henry Clemmey, borough surveyor of Bootle; Mr. William Griffin Davis, Brabant Court; Mr. George Frederick Deacon, borough and water engineer of Liverpool; Mr. Francis Henry Evans, Queen's Gate; Mr. Richard Thomas Hall, Port Nolloth, Cape of Good Hope; Mr. Edward Westley Jacob, Hamilton's Windsor Bridge Iron Works, Liverpool; Mr. Ailsa Janson, Gyéres, Hungary; Mr. Frederick John Johnstone, ex. eng., P.W.D., Government of India; Mr. William Benjamin Leggatt, ex. eng., P.W.D., Madras; Mr. Evan Leigh, Manchester; Mr. Alfred David Lewis, East Greenwich; Major John Frederick Adolphus McNair, late R.A., colonial engineer of the Straits Settlements; Mr. Edward John Theodore Manby, Pisagua, Peru; Mr. Thomas Thomas Marks, town surveyor, Lowestoft; Captain James Law Lushington Morant, R.E., ex. eng., P.W.D., Government of India; Lieutenant William Gustavus Nicholson, R.E., Calcutta; Mr. Wellesley Innes Nead, Stud. Inst. C.E., Westminster; Mr. Francis William Oates, Westminster; Mr. Alexander Payne, Westminster; Mr. William Pelham Richardson, ex. eng., P.W.D., Government of India;

Mr. James Robertson, Iron Works, Holytown, Glasgow; Mr. Alexander Manson Rymer-Jones, late resident engineer on the Mexican Railway; Mr. Charles Edward Shepheard, Ealing; Mr. Rupert Taberville Smith, assistant engineer, P.W.D., Government of India; Mr. Arthur Southam, surveyor to the Wandsworth District Board of Works; Mr. Thomas Samuel Speck, resident engineer and locomotive superintendent of the Metropolitan District Railway; Mr. John Alfred Stockwell, East Greenwich; Mr. Henry Tivy Tomkins, chief surveyor to the parish of St. George's, Hanover Square; Mr. Frederick Robert Upcott, assistant engineer, Indus Valley (State) Railway, India; Mr. Griffin William Vice, assistant engineer, P.W.D., Government of India; Mr. James Henry Waller, Stud. Inst. C.E., Allenstown; Mr. Edward Bentinck Williams, Dock Office, Hull; Mr. Corbet Woodall, chief engineer of the Phœnix Gas Company; and Mr. Henry Robert Woolbert, Westminster.

The Council reported that, acting under the provisions of the bye-laws, they had, since the last announcement, transferred Messrs. John Howkins, jun., and Francis William Webb from the class of associate to that of member, and admitted the following candidates students of the institution—viz., Messrs. Thomas Blan, George Dundas Churchward, Arthur Osbert Cooper, Matthew Curry, jun., Thomas Elmitt Curry, Percy Rigden Dix, Bernard William Flatt, Gustave Adolphe Haas, Frederick James Leigh, Boswell Parkinson Milsom, George Phillips Mulock, Charles Edward Pickford, John Wallis Shores, John Smith, Richard John Symonds, and Herbert Charles Erskine Vernon.

ROYAL NATIONAL LIFEBOAT INSTITUTION

At the last meeting of this institution at its house, John Street, Adelphi, London, Thomas Chapman, Esq., F.R.S., V.P., in the chair, the minutes of the previous meeting having been read by the secretary, Richard Lewis, Esq., rewards to the amount of £583 were granted to the crews of lifeboats of the society for services rendered during the past month. The Whitburn Lifeboat, during a dark and tempestuous night, put off to the stranded barque *Canada Belle*, of Whitby, and after a long absence she returned in safety with two women, two children, and four of the vessel's crew. These persons had been taken into the lifeboat when a heavy sea broke on board, which filled the boat, parted the rope which held her to the wreck, and drove her away. A gallant but unsuccessful attempt was then made to regain the ship, during which time several of the oars were broken. The boat then returned for additional oars beyond the spare ones on board, and, having landed the women and children, they took in four additional men to assist, and proceeded again to the wreck, and after being driven back four times, they eventually succeeded in getting the remainder of the crew off, and brought them safely on shore, making fifteen persons in all the lifeboat was fortunately enabled to save from this wreck, to the great joy of the crowds of spectators on the beach. The Fishguard Lifeboat, [illegible], was also out on two occasions in a strong gale, and was enabled to rescue the crews, numbering altogether eleven men, from the smacks *John and Grace*, of Milford, *Mercy*, of Cardigan, and *Commerce*, *Lion*, and *Ellen Owen* of Cardigan. The Odd Fellows' Lifeboat, at Cleethorpes, was the means of saving the crew of two men from the sloop *Queen Victoria*, of Lynn, which had gone on the Grainthorpe Sands. The Scarborough (Warwickshire Freemasons') Lifeboat had rescued altogether twenty men from the brig *Palestine*, of Whitby, the brig *E. J. D.*, of Nantes, and a boat from the steamer *Allemania*, of Hamburgh. The Lowestoft (No. 1) Lifeboat had gone off to the brig *Republic*, of Dunkirk, which was on the Holm Sand in a dismasted state; on nearing her the anchor was let go and the boat veered down to the wreck. The Greencastle (Londonderry) Lifeboat, after two attempts, brought ashore the master and one of the crew from the barque *L. G. Bigelow*, of Yarmouth, N.S. On this occasion two of the lifeboat men received some injuries through the surging of the tow-rope, the lifeboat at the time being in tow of a steamer. The Abersoch Lifeboat had gone out in the night in a furious gale, which at times had the force of a hurricane, and was fortunately successful in saving the crew of four men from the schooner *Maria*, of Aberystwyth. The Ramsgate, North Sunderland, New Brighton, and Caister (No. 2) Lifeboats had materially assisted to save the distressed brig *Marguerite*, of Cherbourg, schooner *Don*, of Jersey, barque *Vale of Neath*, of Liverpool, and schooner *Montreur*, of Nantes, and their crews of forty-one men. The Swansea Lifeboat had saved from the stranded barque *Paladin*, of Genoa, the crew of twelve men and two pilots. The Tenby Lifeboat had remained alongside the schooner *Aden*, of Liverpool, until she was got to a place of safety. The Port Isaac Lifeboat had brought the fishing luggers *Castle* and *J. T. K.*, of that place, and their crews of eight men, safely to shore, they being in great danger from a heavy ground swell which had suddenly sprung up. The Plymouth (*Prince Consort*), Newcastle (*Dundrum*), and Lyme Regis Lifeboats had saved nine persons from the brigantine *Laurel*, of London, eight men from the barque *Julia*, of Riga, and fourteen men from the barque [illegible] of North Shields. Altogether [illegible] lifeboats of the institution were instrumental during the past month in saving [illegible] from different wrecks, besides rescuing seven vessels from destruction. The silver medal of the institution, a copy of the vote inscribed on vellum, and £2 each, were presented to Mr. Charles Blampied, farmer, Mr. Elias Whitley, farmer, and John Bouchard, labourer, of St. Martin's, Jersey, in acknowledgment of their gallant and determined services in putting off twice in a small boat during a heavy gale from the westward, and proceeding a long distance to the ship *Isabella Northcote*, of Christiania, which had gone on the Écréhou Rocks off the Jersey coast. The three brave men were enabled in the two trips, under the most perilous circumstances, to save the whole of the crew, eighteen in number. The shipwrecked men were landed on a rock, where they were carefully tended in a hut by a poor man named Charles Pince and his wife, who were most generous and hospitable to them. A reward of £5 was voted by the institution to the old couple for those kind services. Other rewards were also granted to the crews of shore-boats for saving life from wrecks on our coasts. In addition to the foregoing rewards, payments amounting to £2250 were ordered to be made on different lifeboat establishments. Several contributions to the society were announced, including £100 from the Dowager Marchioness of Westminster, £50 from W. Gore Langton, Esq., M.P., and £36 17s. 4d. the result of an additional entertainment by the Newport Histrionic Club in aid of the funds of the institution. The late Mr. John Douglas, comedian, of Boston, Lincolnshire, had left the society the whole of his estate after the death of his wife. A report having been read from Captain D. Robertson, R.N., the assistant-inspector of lifeboats to the institution, on his visits to the coast during the past month, the proceedings terminated.

THE VICTORIA (PHILOSOPHICAL) INSTITUTE.

The first meeting of the new session was held at the rooms, Adelphi Terrace, on December 2nd. The attendance was very large. The honorary secretary having announced the election of sixty-two new members since the last meeting, and a large number of additions to the library, Mr. Charles Brooke, F.R.S., vice-president, proceeded to read a paper on "Force and Energy." He held that the principle of the conservation of energy had been misapplied by some writers to the promotion of views that lead directly to materialism, pantheism, or atheism; whilst others, who rightly hold it to be one of their first and highest duties to oppose such views and to counteract their tendency, appear to have held it necessary to impugn the principle altogether, instead of assigning a limit to the scope of its legitimate application. He then proceeded to quote the views held by those who had taken up the question, amongst them being Mr. Justice Grove, Professors Balfour Stewart Ball, Dr. Joule, Dr Tyndall, Herbert Spencer, Baring-Gould, and many others; and, amongst other important matters, gave the result of the investigations on light and heat made by various men of science at home and abroad. Mr. Brooke defined force as a mutual action between different portions or particles of matter, by which they were either attracted or repelled from each other; and the conservation of energy implied that no kind of energy could be produced by human agency, except at the expense of an equal amount of the same kind, or an equivalent amount of some other kind of energy. From this it followed that, so far as physical law was concerned, the total amount of energy in the universe must remain unchanged. But to assert that it was, under all circumstances, unchangeable was a very different matter. The creation of matter must necessarily imply the creation of energy, and those who denied the possibility of the one must that of the other, they must, in fact, deny the existence of Omnipotence. It was much to be regretted that the principle of the conservation of energy had by some been misapplied to questions far beyond its legitimate scope in a fruitless effort to supersede the necessity of an omniscient Creator. In the opinion of the writer, the indisputable establishment of this principle conveyed only a more exalted idea of that infinite wisdom by which the perpetually-recurring transformations and interchanges, not only of the materials, but also of the powers of nature, were rendered subservient to the predetermined laws which governed the comfort and welfare of all created beings. Papers were read from Dr. M'Cann, and by the Rev. Mr. Moore, both of whom were alluded to in Mr. Brooke's essay. A long discussion followed the reading of the paper, after which it was announced that the second meeting, at which new members will be elected, would take place on the first Monday in January, when Dr. C. R. Bree would read a paper "On Darwinism and its Effects upon Religious Thought."

SOCIETY OF BIBLICAL ARCHÆOLOGY.

At the meeting on Tuesday, December 3, 1872, Sir Henry Rawlinson, C.C.B., D.C.L., in the chair, the following gentlemen were duly elected members of the society:—Sir William Tite, C.B., M.P., F.R.S.; M. Le Baron de Cosson, and Mr. H. Morris, Esq., Brentford.

The following paper was then read:—Mr. Smith commenced by describing the discovery of the tablets containing the text of the deluge, which date from the reign of Assurbanipal, King of Assyria, B.C. 668. These tablets were copies from more ancient tablets, which Mr. Smith placed 1600 B.C. The deluge text forms part of a series of legends belonging to the reign of a king named Izdubar. Mr. Smith described how Izdubar, falling ill, went to seek Sisit, the Xisuthrus of the Greeks, who was supposed to have been translated. The legend describes Izdubar as seeing Sisit, who, in answer to a question from Izdubar, relates the story of the flood. Sisit states that the gods revealed to himself the coming deluge, and commanded him to build a ship and put his family and all the seed of life into it; the ship was then to be launched into the sea.

Here there is a break in the document for fifteen lines. Where it again becomes intelligible Sisit relates how he finished the ark,

coated it with bitumen, and placed his treasures and family, his servants, and the beasts of the field in it; he then gives the command of Shamas to him to enter the ark and shut the door, followed by his obeying the command and the commencement of the flood.

The flood is graphically described, and various deities are stated to have been engaged in causing it. After the description of the flood, the story described the stranding of the ship on a mountain in Nizir, east of Assyria, and the sending out from it by Sisit first of a dove, next a swallow, and last of a raven. The animals were afterwards sent out of the ship, and Sisit built an altar and offered sacrifices.

The account concludes with Sisit giving directions to Izdubar how to be cured of a malady, which directions he carries out, and then returns to his city, Erech.

After reading the translation of the inscription, Mr. Smith gave Cory's translation of Berosus and a comparison of the Bible account, the inscription, and Berosus.

At the conclusion of the reading of Mr G. Smith's paper, the chairman, Sir H. Rawlinson, offered some remarks on the probable age of the Babylonian legend of the deluge. He showed grounds for believing that the historical chronology of Babylon ascended to a period at least 5000 years before the Christian era. There was a recorded date in the inscriptions of B.C. 2280 for the conquest of Babylon by the Medes, and the number of kings assigned by Berosus to the dynasty which preceded that event would place the commencement of the historical era in about B.C. 5150. The deified sage to whom Mr. Smith had given the provisional name of "Izdubar," and who in his search for immortality had learnt the legend of the deluge from Sisit, must be placed beyond the historical limit, but how much beyond it was of course impossible to say. The Greeks, who had picked up the early traditions of Babylon, appeared, however, to indicate a date by placing the Proto-Patriarch, from whom the Babylonians had acquired the knowledge of astronomy, astrology, magic, and genethlialogy, 6000 years before Plato, or 5000 years before the Trojan war—that is, above 1000 years before the commencement of the historical period. The character of this proto-patriarch, who by the Greek traditionists was sometimes named "Zoroaster," and was sometimes compared with the Biblical Nimrod, would seem also to correspond with the Izdubar of the inscriptions, though there was no possibility at present of bringing the names into relation. If Izdubar, the first civiliser of the Babylonians, lived about B.C. 6400, they would still have to ascend to a much earlier period for the age of Sisit, who was the hero of the flood, and from whom the legend professed to come. Sir Henry doubted very much Mr. Smith's readings of Sisit and Ubaratutu for the names of the ark-builder and his father, and would not believe those forms to be identical with Xisuthrus and Otiartes of Berosus. It was curious that the former name might also read Yamashid, "ruling the sea," and that the primæval sage of Babylon was actually named in the native traditions collected in Ibn Wakshi's celebrated work on the agriculture of the Nabathæans, Yanbu-shad, a title which certainly appeared to be identical with the Arian prototype, Yemo-shaito or Jemshid. This might be a mere coincidence; but there were many other points of contact between Arian and Babylonian tradition, and the subject certainly required investigation.

On the geography of the legend, Sir Henry remarked that the Nisir of the inscriptions exactly answered to the Ararat of the Bible, not to the northern mountain near Erivan, which had now usurped the title, but to the true Ararat of Assyrian and Armenian geography—namely, the precipitous range overlooking the valley of the Tigris to the north-east of Mosul. The particular hill of this range upon which, according to the local tradition, the ark had rested, and where its remains were supposed to be visible to the present day, had always borne the Arabic name of Judi, which there could be no doubt was the representative of the name of Guti, which was attached to Nizir in an Assyrian geographical list.

Sir Henry further expressed great confidence in the genuineness of the extracts from the work of Berosus, which had been preserved to us by Eusebius and other copyists, since the proper names, under their Greek disguise, could usually be identified with the original Babylonian terms. It was certain that Berosus in describing the deluge must have had under his eye the original legend that had been translated by Mr. Smith, though perhaps there was some mistake in assigning the legend to Xisuthrus: and it could further hardly be doubted that the account in Genesis was the version of the same legend which had been carried away by the Abrahamic colony in their original migration from Ur of the Chaldees to Harran and Palestine.

ZOOLOGICAL SOCIETY OF LONDON.

December 3rd, 1872, the Viscount Walden, F.R.S., president, in the chair.—The secretary read a report on the additions that had been made to the society's collection during the months of October and November, amongst which were particularly noticed a nippon ibis (*Ibis nippon*), and other birds, presented by R. Swinhoe, Esq., F.Z.S., H.B.M. consul at Ningpo, China. Mr. P. L. Sclater exhibited a nest of the tigereta (*Milvulus tyrannus*), containing one egg of that bird and nine of the parasitic *Molothrus bonariensis*, which had been sent to him by Mr. W. H. Hudson, C.M.Z.S., of Buenos Ayres. Mr. H. E. Dresser, F.Z.S., exhibited a series of skins of eagles of Europe and India. After a careful investigation, Mr. Dresser had come to the conclusion that three good species had hitherto been included under the name of the imperial eagle, four under that of the spotted eagle, and two under the name of the tawny eagle. Mr. Dresser pointed out the various plumages and localities of these species.

Professor Owen, F.R.S., read a paper on "The Osteology of the Marsupialia," being the fourth of his series of papers on this subject. The present communication contained a description of the trunk and limbs of the wombats (*phascolomys*). A communication was read from Mr. R. B. Sharpe, F.Z.S., entitled "Contributions to the Ornithology of Madagascar." A communication was read from Dr. J. E. Gray, F.R.S., on "The Fossane of Madagascar (*Fossa d'Aubentonii*)," of which animal the British Museum had recently received specimens. A second communication from Dr. Gray contained notes of a terrapin from British Columbia, which had been presented to the British Museum by J. K. Lord, Esq., F.Z.S., as the *Actinemys marmorata* of Agassiz. A communication was read from Sir Victor Brooke, Bart., F.Z.S., giving the description of a new species of antelope from the river Gambia, living in the society's menagerie, which he proposed to call *Nanotragus nigri-caudatus*. A communication was read from Dr. A. Gunther, F.Z.S., containing notes on a hitherto unpublished drawing in the Buchanan-Hamilton collection, representing *Barbus beavani*. Three short communications were read from Mr. Andrew Garrett, of Tahiti, in which he gave descriptions of two new species of *Separatista*; two new species of *Caecum*, from the Viti Islands; and a new species of *Scissurella*, from the Paumotu Islands.

The next meeting of the society for scientific business will be held at the society's house in Hanover Square on Tuesday, the 7th of January, 1873, at half-past eight o'clock, p.m., when the following communications will be made:—1. Dr. Bowerbank, F.R.S. "Contributions to a General History of the Spongiadæ. Part IV." (Received 1st November, 1872.) 2. Dr. Bowerbank, F.R.S.: "Report on a Collection of Sponges found at Ceylon by E. W. H. Holdsworth, Esq." (Received 6th November, 1872.) 3. Mr. A. H. Garrod: On "The Value in Classification of a Peculiarity in the Anterior Margin of the Nasal Bones of some Birds." (Received 3rd December, 1872.)

INSTITUTION OF CIVIL ENGINEERS.

At the Fifty-fifth Annual General Meeting held on December 17th, 1872—T. Hawksley, Esq., President, in the chair—it was stated in the report that, since the last annual meeting, the council then elected to conduct and control the business of the institution had been mainly occupied in following in the footsteps of their predecessors, by whose exertions the society had been brought to a most flourishing condition,—a condition which had been well sustained during the past year.

Reference was in the first place made to the completion of the premises in the occupation of the institution, which, since their enlargement, had not previously been considered sufficiently dry to allow of their being decorated. The works had been carried out by Messrs. J. G. Crace and Son, under the direction of Mr. Thos. H. Wyatt, and the result was regarded as very satisfactory. The introduction of cloth in the lower compartments of the walls of the meeting room had contributed to subdue the resonance from the hard surface of the parian cement, and had sensibly improved its acoustic properties. The alterations effected during the vacation had included a great addition to the bookshelf accommodation in the library. This addition was rendered necessary by the recent large accessions—either by presentation, by bequest, or by purchase. It was thought that provision had now been made for the next six or seven years, on the supposition that the present rate of increase continued. The library contained about eleven thousand volumes, almost exclusively relating to mechanical science and engineering, and as a technical collection, devoted to a special subject, it was believed to be without a rival either in the United Kingdom or abroad.

From an enumeration of the topics discussed at the ordinary meetings, it was seen that there had been an opportunity of eliciting opinions on various branches of practice; and a reference to the two volumes of "Minutes of Proceedings," issued during the recess, would show that many members had availed themselves of the opportunity to place on record their views and experience on the several matters brought forward. To the authors of some of the communications on which these discussions were founded, medals and premiums had been awarded, viz.: Telford medals and premiums to Messrs. B. Leslie, Carl Siemens, W. Bell, J. H. Latham, M.A., and G. Gordon; Telford premiums to Messrs. F. A. Abel, F.R.S., and B. Britten; and the Manby premium to Mr. C. Andrews.

In addition to the ordinary meetings, a short series of special meetings had been organised to enable the students to read and discuss papers among themselves. The members who presided on these occasions had reported that the aptitude, the intelligent discrimination, the apparent sustained attention throughout, which characterised those taking part in and present at these proceedings, were a pledge that in the future the students would continue to exert themselves for their own individual improvement, as well as for the benefit of their fellow-students. For the essays contributed for reading on these evenings Miller prizes had been bestowed upon Messrs. O. Brown, A. T. Atchison, B.A., J. Addy, A. E. Preston, and W. P. Orchard, B.E. On the invitation of the president, a party of eighty of the students—the largest gathering of the kind that had ever taken place—in the course of the summer visited the Leicester Water Works, when Mr. Hawksley pointed out and minutely described the peculiarities of the undertaking. For the opportunity thus afforded for acquiring professional knowledge, as well as for the liberality with which the whole programme was conceived and carried

out, the warmest thanks of the Institution are eminently due to the president.

During the past session 17 associates were transferred to the class of members. The elections had comprised 3 honorary members, 23 members, and 119 associates, and two associates were restored to the register, together 142. On the other hand the losses by death, retirement or erasure, amounted to 45, so that the effective increase was 97, being at the rate of nearly 5½ per cent. in the twelve months. There had been 64 admissions to the class of students attached to the Institution, while 30 were removed from the list, representing a gain of 34, or at the rate of 18 per cent. in the past session. There were on the books on the 30th November last 16 honorary members, 752 members, 1115 associates, and 237 students, together 2120, as compared with 1000 ten years ago. In order to show the progress of the Institution from its foundation, on the 2nd January 1818, to the present time, a table had been compiled, from which it appeared that, disregarding the students, the elections into the corporation in the eleven quinquennial periods, had been 59, 106, 104, 138, 313, 192, 247, 226, 300, 637, and 693, together 3024, while the number of such elections still remaining on the books were respectively 2, 7, 8, 29, 87, 65, 115, 146, 245, 558 and 667, making a total of 1929, or very nearly two-thirds of the gross number elected.

The deaths recorded during the year have been: The Earl of Lonsdale, honorary member; Nathaniel Beardmore, David Reid Edgeworth, Joseph Walter Gale, John Mortimer Heppel, Durand Kershaw, Andrew Murray, C.B., William Scamp, Richard Smallman, and Henry Johnston Waylie, members; and James Bagnall, Edward Banfield, Joseph Baxendale, John Van Norden Bazalgette, Edward Ladd Betts, Edwin Bidder, Charles William Dixon, Thomas Dunn, John Samuel Enys, Charles Haslett, Thomas Howard, Robert Jobson, Frederick Marrable, Edmund Morel, Christopher Pattison, Augustus Siebe, William Sykes, Robert Harry Inglis Synnot, and Arthur Valentine, associates.

The abstract of receipts and expenditure as certified by the auditors, showed that the current subscriptions alone, £5643 16s., had exceeded the whole of the disbursements, £5586 11s. But the income proper had really amounted to £6574 10s. 8d., the fees, and building and publication funds on election, and life compositions to £1294 4s. 6d., and the dividends on trust funds to £411 2s. 3d., together £8279 17s. 5d. whereas the expenditure on the general account, including the cost of the Minutes of Proceedings, less received under that head, had been only £5221 18s. 11d., and for premiums under trust, £249 18s. 9d. A sum of £2908 18s. 9d. had been invested in the purchase of 1338 London and North Western, and of £1500 North Eastern Railway Companies Four per cent Debenture Stocks. The late Mr. Thomas Howard, who was for thirty-seven years an associate, had bequeathed to the Institution the sum of £500, the interest of which he directed to be applied for the purpose of presenting a prize for a treatise on the uses or properties of iron, or for the invention of some new and valuable process relating thereto. This bequest had been paid to the treasurer, and had been invested in the purchase of £551 16s. 6d. New Three per Cents. The nominal or par value of the funds belonging to the corporation was £14,994 1s. 8d., and of the trust funds under the charge of the Institution £13,389 13s. 2d., while the cash balance amounted to £270 16s. 1d., making a total of £28,654 9s. 11d. as compared with £25,373 3s. 4d. at the date of the last report. After the reading and adoption of the report, the premiums were presented by the president. The cordial thanks of the meeting were unanimously accorded to the president for his zealous efforts to promote on all occasions the interests of the Institution and of its members. The thanks of the meeting were likewise given to the vice-presidents and other members of the council, for their co-operation with the president and their constant attendance at the meetings; to Mr. Charles Manby, honorary secretary, and to Mr. James Forrest, Secretary, for the manner in which they had performed the duties of their offices, and to the auditors of accounts for their services. The scrutineers of the ballot (to whom a vote of thanks was passed by acclamation) announced that the following gentlemen had been elected to fill the several offices in the council for the ensuing year — Thomas Hawksley, president; John Frederic Bateman, Thomas Elliot Harrison, George Willoughby Hemans, and George Robert Stephenson, vice-presidents; James Abernethy, Sir William George Armstrong, C.B., William Henry Barlow, Joseph William Bazalgette, C.B., George Berkeley, Frederick Joseph Bramwell, George Barclay Bruce, James Brunlees, Sir John Coode, Charles William Siemens, Sir Joseph Whitworth, Bart., and Edward Woods, members; and James Timmins Chance, M.A., David Forbes, and James Grierson, associates.

REVIEWS.

(*Continued from page 7.*)

Our author then passes to the effects of accumulation of chemical heat or the reverse in metals, showing that thermic metals repel heat and attract cold, and have a tendency to form change, that chemically athermic metals attract heat, and have but little tendency to form change, which is considered a heat effect, for the more a metal is heated or the hotter it is naturally, the more readily it will transform chemically, that thermic chemicals attract the athermic chemicals and *vice versa*, hence chemicals possessing strong chemical affinities must be in opposite states of chemical heat.

The fifth and sixth chapters treat of the three great steps of chemical combinations, attraction heat changes, and heat equilibrium, as illustrated by the thermics of carbon, platinum, mercury, hydrogen, oxygen, nitrogen, chlorine, phosphorus, of cooling or refrigeration, or athermising in chemistry, as seen in platinum and its congeners.

Dr. Hall then proceeds to consider the effects of heat equilibrium in chemistry, and demurs truly that equality or similarity in their heats produce repulsion of the ingredients of chemical compounds, and refers to the polarity of repulsion of the ingredients of compounds, and affirms the production of repulsion and attraction, like electric repulsion and attraction.

He afterwards passes to the consideration of true chemical affinities and aptitudes, chemical shapecraft, chemical activity, chemical inactivity, and morphigen.

Then follow the thermics of the combinations of acids and bases, whence we are conducted to the consideration of the decomposition of water by metals, showing that heat is then required to evolve hydrogen, good fuel being therefore needed. He shows what is good fuel, and that zinc not being good enough fuel requires further the combustion of an acid to decompose water, further that hydrogen and oxygen is the best fuel known.

This brings the reader to the second part of the treatise, which relates to the galvanic battery. We cannot do better justice than by quoting from that part of this treatise which makes a comparison between the old galvanic theory as compared with the new:—

Upon matters that can be decided by the crucial test of experiment, and about which, therefore, there cannot be a doubt, such as the electric states of the zinc and platinum plates and the fluid of the cell, the old interpretation and the new attempt in this disquisition are and must be at one. For both the old and the new theory and experiment make out that the zinc is negative, and the platinum and the fluid of the cell positive, as to heat and as to electricity. About the direction of the current between the zinc and the platinum plates, and the current's existence through the fluids of the cells, two things not so easy as at first sight seems of direct and satisfactory proof, the old and new interpretations are at complete variance. By the new interpretation proposed in these pages, the current of the principle in the galvanic cell passes *from* the zinc *to* the platinum, exactly the reverse of the old ideas. But the new theory seems to me, of course, the more reasonable. For we find the zinc of the galvanic cell, according to every theory, old or new—better still, according to experiment—is in the minus state, which means, if it means anything, that something has been subtracted from galvanic zinc. Galvanic zinc has always the sign of subtraction attached to it. What has become, then, of this something that has been so subtracted from the galvanic zinc? Surely it must have gone somewhere.

To galvanic platinum, on the contrary, is attached always the plus mark, the sign of addition. Whence has come this something that has been added to the galvanic platinum?

By the new theory, the way of answering these questions is to suppose that which has been added to the platinum has been taken, through the wire, from the zinc: for the subtraction from the galvanic zinc and the addition to the galvanic platinum are synchronous and equal, and we know that the platinum is quite as ready for the addition as zinc is for the subtraction; and, besides, an excellent means, the wire, exists for effecting the subtraction. In the old theory it is said that that which is subtracted from the zinc is in totality added to the *fluid* of the cell, and from the fluid it is added completely or in totality to the platinum. But this is impossible. For if we by this old theory analyse the electrics of a galvanic cell, we find that in it there are two metals, one zinc, negatively electric, and the other platinum, non-electric, both immersed or in contact with a fluid positively electric. In these circumstances, by all the known laws of electricity, all the electricity of the positive fluid must at once be discharged upon the negative zinc in contact with it. Not a particle of electricity can in this case find its aberrant way to the non-electric platinum. Positive electricity in contact with two metals, platinum and zinc—the first non-electric and the second negatively electric—will certainly, if electric laws lie not, not go to the non-electric metal platinum, but will be at once and in totality discharged into the negative metal zinc. So that, if the old theory is held, all the electric actions of a galvanic cell would be confined to electric discharges from the zinc to the fluid, and from the fluid back again to the zinc. But this does not correspond to the facts observed, is in direct opposition to the facts observed. By the new theory, it is clear that the effect of the disposition of matters in the galvanic battery is to render zinc when action commences, minus or negative, that is, to subtract something from zinc. It is evident, therefore, that before that action began zinc must have had the thing taken from it when the action was established; you cannot subtract *one from nothing*. Zinc of the battery must have had electricity or heat latent in it before action, in order to have yielded it during the action of the battery; and because platinum received the thing added to it so readily, there must have been rather a deficiency of the thing added in platinum. And this we know is the case, for we know by our axioms that zinc is a thermic metal, and has therefore heat, and platinum is an athermic metal, and therefore is deficient in heat. And all this but means that the positive state of platinum and the negative state of zinc are a second step or scene in the phenomena of the galvanic battery, the first step or scene being exactly the reverse—things commencing by zinc existing positive and platinum negative, thus—

First scene in the phenomena of the galvanic battery consists of a quantity of electricity, or heat latent in zinc, and deficient in platinum—zinc being thus plus, and platinum minus as to electricity or heat.

Second scene in the galvanic battery consists of zinc losing its latent electricity or conditional heat to change shape into oxidity or salines,

zinc thus getting the losing or subtraction sign of minus upon it—that is, becoming negative and this lost zinc heat passes through the wire—its by far easiest way, and therefore only way, to the platinum, which thus gains heat or electricity, and acquires the increase or plus sign upon it, or becomes positive

Third scene of the galvanic battery consists of this electricity's discharge from the platinum to the hydrogen of the fluid, and the equilibrium restored by the escape of the hydrogen.

In short, in the galvanic battery, by the new theory, the platinum is simply charged electrically by the zinc through the wire, the easiest way, and discharged by the hydrogen, which escapes forthwith from the field of action, and thus restores the equilibrium. And that the current comes from the zinc, and goes along the wire to the platinum, we have absolute ocular proof. For in the case of the two charcoal points, in what is called the "voltaic arc," it is that charcoal point that is connected with the burning zinc pole of the battery, and that therefore by the new theory first receives the heat—it is that very zinc-connected charcoal point that first becomes white hot or incandescent. By the new theory it must be so, for by that theory the heat must first reach the charcoal point connected with the burning zinc. Theory and fact are therefore in perfect accordance. The new theory says that that charcoal point that first receives the current, first shows it by becoming incandescent. The new theory says that that charcoal point which the heat current first reaches first becomes heated or white hot, and what the new theory says accords with what the fact indicates.

These views Dr. Hall supports by able argument and statement of illustrative facts, but we must warn our readers that although we have analysed this work at such length, and quoted much from its pages, we have by no means exhausted its contents. If they take any interest in the subject they must get the book and examine it for themselves.

APPLICATIONS FOR LETTERS PATENT.

(*Continued from page 2*)

elastic fabric.—A. F. Shanks. Making cases or boxes of thin sheet metal, and in apparatus therefor.—H. A. Bonneville Furnaces for burning lime, plaster, cements, ceramic productions, and for similar purposes (com) B. J. B. Mills. Improved process for cleansing cotton waste and fibrous substances saturated with oils and mixed with débris and other matters (com.)—R. Smith. Steam generators. J. Allison. Planing wood or other material, and in the machinery or apparatus employed therefor —W. C. Stiff. Metallic cop tubes or caps used in spinning —W. Marriott. Manufacture of salts and oxides of lead, and in apparatus therefor.—A. M. Clark. Manufacture of stearic acid (com)

On November 9th —3324 to 3340. R. J. Lees. Fuel Economisers.—T. Bowlas. Arrangements for damping in machinery employed in the spinning or doubling of cotton or other yarn. —C. Duggin. Fastening or securing window sashes (com)—A. Harris Breech-loading small-arms —C. Lund Cutting instrument for opening metal boxes or cases. G S Newman. Means of and apparatus for signalling between carriages or vehicles of railway trains, and in means or appliances for connecting the wires of adjoining carriages or vehicles —A C Pelly Manufacture of peat fuel (com)—A. Prince. Apparatus for feeding steam boilers and raising water (com.)—A. Prince. Apparatus for raising water (com.)—J. Grantham. Tramway carriages.—T. H. Rushton. Machinery for doubling and winding yarn — C. de S Marie. Tanning hides and skins.—P. Nowall and J. Barker. Steam traversing leather roller for butts, bends, bellies, and heads.—F. Fleming and J. Milner. Apparatus for flattening or shaping wire to be used in the manufacture of wire cards and reed wires for looms for weaving.—W. R. Lake Compressed air motor (com.)—J. T. Hopkinson Window sash fastenings.—C. F. Zindars. Pneumatic signalling and communicating apparatus.

On November 11th. — 3341 to 3356. — T. W. Kennard. Indicating the height of the water in steam boilers.—S. Alloy. Apparatus for measuring, pumping, or obtaining motive power from liquids.—A. Barr Motive-power engines to be worked by water —J. B. Stearns. Electric telegraphs (complete specification). — E Cogswell, N Wilkins, and J. B. Wilkins Fulling machines.—R. Hanson. Steam engines.—W. P Wilson. Apparatus used in the manufacture of gas, which improvements are also applicable to other purposes.—R. Field. Sewage tanks and in the means of effecting the intermittent discharge of liquid from them or other vessels by syphons. —R Kendall Dish or stand for holding pressed or cooked meats, Stilton cheese, and such like provisions —H. H. Murdoch Tanning hides and skins (com)—T Shutt and E Brooks. Apparatus for economising fuel —G Ash. Stoves or fire-grates —P. Brimelow Warping or beaming mechanism —F Macken. Machinery or apparatus for preparing and spinning wool and other fibrous substances (com)—H Y. D Scott. Apparatus to be used in the treatment of sewage deposits and other like substances. —J. A Manning Treatment of human fecal matters and in the apparatus or means employed therein.

On November 12th.—3357 to 3371. — P. Brimelow and S Southerst Railway coupling mechanism —J Pinkerton. Signalling on railways and in apparatus or means employed therefor —G S. Hare and C Stuart Method of and apparatus for stopping and plugging the tubes of steam boilers —E. P H Vaughan Mariner's compass (com) — L. C Fulton. Steam engines —L. Banks Manufacture or composition of fuel —R Bewley Boiler fittings, also partly applicable for other purposes —H Hillman Sewing machines —W R Lake. Improved kaleidoscope (com) F W Wade Water-waste preventors H C Ash Iron safes — C A Randall. Printing telegraphic apparatus and in the arrangement of the circuits to be used in connection therewith (partly com)—W Richardson. Machinery for burring or cleaning, opening and sorting wool and other fibrous materials. —A. P Price. Annealing of wire (com) —V D. de Michele. Manufacture of Portland cement, and in apparatus to be employed therein, and for other purposes

On November 13th — 3372 to 3388 —W T. Read. Cocks or taps for bottling H E. Towle Fluid motors for driving sewing machines and other small or light machinery or apparatus (partly com)—R Punshon Shovels or instruments for feeding fires with fuel —A. B Vorrier. Stoves, kitchen ranges, kitcheners, and fire grates of various kinds —J. Buchanan, jun Centrifugal drying and cleaning machines —J Lyall. Looms for weaving —F. N. Target Preserving food, and in the means or apparatus employed therein —J E Palmer. Production of copies of photographic pictures, and in shading and colouring the same.—H. Jones Improved life-belt.—J. Farmer Musical instruments E. A. Cowper. Separating the fibres of paper pulp, and apparatus therefor — H W Whitehead Machinery for burring wool and other fibrous substances —C. H. Murray Chain pumps. R S. Taylor, jun Construction of ships or other vessels (com) —J H. Johnson Pipe joints (com)—J H. Johnson Construction of ships or vessels (com) — A. M. Clark Bolt-threading and nut-tap machinery (com)

On November 14th —3389 to 3399 —B. J B. Mills Machinery for cleansing, scouring, or smutting grain and seeds (com) B Brown. Construction of bolsters for the spindles of machines used in spinning and doubling cotton and other fibrous materials —G Laurence Improvements in knickerbockers.—W R. Lake. Reaping and mowing machines (com)—G. Clark Preserving animal and vegetable articles of food, and in vessels, apparatus, and appliances for such preservation.—T White Construction of ships and vessels, and also in the construction of railway and other carriages —W. C. Church. Safety-valves and self-acting apparatus for preventing explosions of or injury to boilers or generators containing steam or other fluids, parts of which improvements are applicable to steam and hydraulic valves.—H. Schildberg. Construction of velocipedes.—A. M. Clark. Air-heating furnaces, or apparatus (com.)—A. M. Clark. Baling press (com.)—A. M. Clark. Boring and drilling machines (com.)

On November 15th.—3400 to 3415.—H. E. Harrold. Coupling for the shafting of machinery. —J. Tenwick. Construction and in the form of anchors for ships and vessels.—D. K. West and W. West. Apparatus for pressing cotton and other materials, and for securing bales, part of which invention is applicable to other machinery.—M. J. Roberts. Engine governors and apparatus connected therewith.—J. C. Mewburn. Apparatus for purifying boiler feed water (com)—J Ré. Machinery for manufacturing horse-shoes (com.)—E. T. Hughes. Arrangements and apparatus for weighing the contents or loads of waggons or other vehicles having springs (com)—J. Steel. Improved personal indicator for offices.—T. Marsh. Apparatus for lubricating the spindles employed in machinery for preparing, spinning, and doubling cotton and other fibrous substances.—D Stanley Method of and apparatus for obtaining and applying motive power.—W. E. Prall Combination and arrangement of devices for supplying the tanks and tenders of locomotives with water (complete specification.)—W. E Newton Stench traps and in apparatus for making the same and other curved or partly curved articles (com)—O. Alsing. Treatment of nightsoil and other refuse matter —T. Ryder and G Ryder Construction of machinery for forging —A M Clark Machinery for moulding india rubber and other plastic materials (com)—G. T Bousfield. Machinery for cutting and polishing glass, gems, marble, stones, and other similar hard substances (com.)

On November 16th.—3416 to 3429.—B. Miller. Machinery or apparatus for punching, cutting, shearing, and planing iron or other metals — F. Hahn Manufacture of steel and malleable iron, and in furnaces therefor (complete specification)—A. Turner Manufacture of elastic fabrics T. J Smith. Apparatus for facilitating the stoppage of carriages, carts, and other vehicles upon common roads (com.)—J. Z Kay Pipe joints.—T Bagley. Varnish.— J H. Johnson. Refrigerating or freezing apparatus, parts of which improvements are applicable for regulating the flow of fluids generally (com) —T. C. Blyth. Stoves for heating apartments, halls, and other like places. — E. T. Hughes. Elastic goring for boots and shoes (com.)— G. H Chinnock. Sheet-metal cans. —I Gregg. Bricks —R. B. Jackson. Racks for bottles —S. Holman. Apparatus for raising and lowering heavy bodies, parts of which improvements are applicable to the raising and forcing of fluids generally.— D. Cockburn. Barrows (com)

On November 18th —3430 to 3444.—J. S. Pode. The regulation of the flow of liquids from infants' feeding bottles —T. Blockage. Means for promoting the combustion of fuel or for lessening the production of smoke in fire-grates or stoves E. P. H. Vaughan, F.C.S. Drawing pens (com) —W. Rose Hollows and rounds and bead and moulding planes.—C. D. Chauncy. Apparatus for cleaning out the grooves of tramway rails.—J. Foster. Feeding and delivery apparatus applicable to printing and folding machines —J. Weir Apparatus to be used as a safety valve or in connection with other safety valves.—H. E. Wagner. Paper and parchment —W R. Lake Inkstand (com.)— J. C. Morgan, H. Macaulay, and W. Waide. Improvements in water-waste preventers (complete specification) — F. J. Cheesbrough. Skate fastening (com.)— A. M. Clark. Walking sticks (com) — S. W. Worssam Parquetry. —J. L Norton Drying wool, hay, straw, and other materials, and for bread and biscuit-baking —J. Tall Floors and other parts of buildings and in warming and ventilating the same.

On November 19th —3445 to 3457.—R. Hornby. Treating fatty materials in combination with various kinds of pitch, alkalies, and oil, also in the treatment of animal, vegetable, and mineral oils for lubricating purposes.—C. D. J. Seitz. Apparatus for and method of treating wood and other similar substances for the manufacture of half stuff and paper.—H. Grosvenor. Manufacture of bookbinders' cloth and imitation leather.—W. R. Sykes and F. R. Francis. Working railway signals, in registering the arrivals and departure of trains, and in the means or apparatus employed therein, part of which invention is applicable to other registering purposes.—R. Davison. Brewing apparatus. R. Snape. Looms for weaving.—C. L. Siecinoski. Preparation of autographic tracing paper, and in the fluid employed in connection

with the same. J. Furness. Metallic packing for piston-rods, valve-rods, and other similar purposes (com.)—J. Riley. Roofs and other parts of buildings.—J. M. P. O'Callaghan. Means or apparatus for lowering and raising ships' boats.—E. Sang. Spinning machinery.—J. T. Holcroft. Waste-water preventers for water-closets, lavatories, urinals, and other like purposes.—C. W. Melter and T. W. Smith, and C. Minasi. Tobacco pouches.

On November 20th.—3450 to 3473.—J. M. Zamoyski and W. Jackson. Constructing (with reference to independent axles and crank shafts) railway locomotives and other engines, railway carriages, vans, and trucks, as well as tramway carriages.—P. Kirk. Rolling mills.—A. Morgan. Purifying and amalgamating gum resins, including Kauri gum.—A. Fraser. Apparatus for composing types.—J. Thomas. Supporting and protecting telegraph wires.—E. G. Johnson. Apparatus for perforating, piercing, or punching paper, cardboard, and other materials, especially applicable to the cancelling of or producing indications on railway tickets and other passenger tickets.—E. Hills and B. Biggs. Deodorising and purifying sewage and other excrementitious matters, and in obtaining certain useful products therefrom.—S. Hemingway. New or improved means or apparatus for packing dry soap, starch, corn flour, baking powder, mustard, tea, coffee, or any other article in a powder or granulated state.—T. C. Selby. Protection of the chest and lungs of animals used for riding or draft purposes from inclement weather.—T. D. Tully and J. T. Robinson. Making gas and water supply pipes, equally applicable as a preventative against fire.—J. A. C. de Latouche. Ordnance and other fire-arms, and in apparatus connected therewith, part or parts of such improvements being applicable to other purposes.—A. Dockray. Machinery or apparatus for roving, spinning, twisting, and laying fibrous material.—W. G. Brunner. Annealing and cleansing the surfaces of iron or other metals (com.)—S. Bourne. Improvements in or applicable to screw and other sorts, spindles, and shafts, and in nuts, knobs, or handles and fasteners suitable to be used with bolts, spindles, or shafts.—C. E. Harrison. Heating apparatus.—C. W. Harrison and A. H. Harrison. Apparatus for charging or impregnating atmospheric air with vapour of hydrocarbon liquids.

On November 21st.—3474 to 3491.—S. F. Van Choate. Telegraphing.—J. M. Ure. Measuring taps or apparatus for drawing off and measuring liquids.—C. J. Appleton. Sewing machines.—P. Jensen. Steel (com.)—C. W. Siemens. Furnaces and apparatus for melting, refining, and working out glass (partly com.)—H. S. Maurel. Ruling paper.—C. O'L. L. Prendergast. Enabling a passenger in a train (railway) communicating with the guard and engine-driver at one and the same time.—E. T. Hughes. Motive-power engine (com.)—E. Pfeiffer. Lock or fastening for bags, satchels, and other like articles (com.)—S. Johnson. Hop-straining cask preserver.—A. McKenzie. Apparatus for operating the moving heads of carriages.—W. E. Gedge. New or improved apparatus for washing linen in laundries and elsewhere, and also for various other purposes (com.)—J. H. Johnson. Seed or grain separators (com.)—W. B. Thompson. Governors for marine engines.—A. M. Clark. Breech-loading fire-arms (com.)—C. A. Blogg. Improved water-waste preventer cistern.—W. Brooks. Joining the ends of pipes or tubes (com.)—C. J. Ball. Machinery and apparatus for drilling and boring holes.

On November 22nd.—3492 to 3503.—C. E. Wetton. Portable appliances in magneto-therapeutics.—J. A. Barker and D. Jones. Portable adjusting points for tramways.—J. S. Grierson and R. Philips. Apparatus for applying bronze or dust colours upon paper or other surfaces.—C. O'L. L. Prendergast. Protecting cheques from forgery.—J. C. Morton. Coupling or connecting together passenger or other carriages or trucks on railways. (Complete specification.)—T. H. Cotton. Fuel to be used as a substitute for and to economise coal, and the means of applying same to feed steam-boiler and other furnaces where steam can be obtained.—D. Greig and G. Greig. Steam and other multiple furrow ploughs.—J. H. Bass. Shields or collars for preventing the escape of oil or other lubricating fluid from railway axle-boxes.—T. Brown. Machinery for the manufacture of tires for wheels, and also for the manufacture of hoops and rings for various purposes.—J. H. Player. Utilising waste products obtained in the manufacture of phosphorus, and in the manufacture of certain metallic compounds containing phosphorus.—T. A. Howland and C. G. McKnight. Manufacture of gas, and in apparatus therefor. (Complete specification.)—W. Birch. Treating horny and other analogous animal substances for the purpose of converting them into an elastic substance, to be used in place of whalebone bristles, and for other purposes for which such elastic substance may be applicable.

On November 23rd.—3504 to 3523.—E. Ensor. Steam-boiler and other furnaces, and in the means for supplying the same with fuel.—R. F. L. Jenner. Manufacture of Dinas fire-bricks.—H. B. Young. Apparatus for raising, lowering, and holding Venetian and other blinds, part of which improvements are also applicable to various other analogous purposes.—R. Brydon, J. S. Davidson, and T. A. Warrington. Machinery or apparatus for drilling, boring, or cutting rock or other hard substances.—R. B. Stewart. Heels of boots and shoes.—A. Baumann. Steam engines (Complete specification.)—G. Haseltine. Improved lever and screw press (com.) (Complete specification.)—E. Ludlam. Sifting cinders and other similar kinds of material that may require sifting.—C. Owen. Electrical intercommunication between passenger and guard, guard and guard, and guard and engine-driver.—W. Wright. Apparatus for preventing the waste of water, applicable to waterclosets and other purposes.—J. Lamacroft. Preparing paper for transmission by post or otherwise, without the use of wrappers or envelopes.—S. Osborn. Finger beams for reaping and mowing machines, and in apparatus therefor.—J. Howard and E. T. Bousfield. Steam cultivating machinery.—T. Price and A. L. Saniscovsky. Better manufacturing of tin and terne plates.—S. B. Allport. Breech-loading small-arms.—J. Smiles. Breech-loading small-arms.—J. C. Ramsden. Severing or dividing double-piled fabrics.—J. B. C. A. Papier. Prevention of smoky chimneys, giving at the same time perfect ventilation for houses, ships, lanterns, and public buildings.—W. H. Thompson, E. Harris, and G. French. Skate.—C. W. Harrison. Apparatus for heating water and generating steam.

On November 25th.—3524 to 3540.—R. Hadfield. Improved method for fixing and setting wheels truly upon their axles and shafts, and for making such wheels, axles, and shafts more particularly applicable to carts, colliery tramway, and other similar wheels.—J. Mitchell. Cretaceous hydrocarbon fuel.—J. U. Askham. Manufacture of angles in iron, steel, and other metals.—J. Farran. Fancy weaving.—M. Howe. Heels for boots and shoes.—D. Curror. Filtration and purification of fluids, and in the manufacture of manure.—J. Jones. Steam boilers.—R. Faulkner. Applying and fixing dry colours on paper, canvas, and other porous surfaces, and in the means employed for this purpose.—E. L. Ward. Pipe for smoking tobacco.—J. R. Belford. Manuring, disinfecting, and deodorising.—G. Thorneloe. Dip pipe, forming part of gas apparatus for use in making gas.—G. Chambers. Heels for boots and shoes.—Hon. F. A. Wellesley. Torpedoes (com.)—J. C. MacDonald and J. Calverley. Printing machinery.—J. Needham. Manufacture of dagger, table, dessert, fish, and carver knives and forks.—S. Hallam. Apparatus for raising or forcing fluids and liquids.—G. G. Tandy and W. Strondley. Lamps.

On November 26th.—3541 to 3558.—T. North. Railway axle-boxes, also applicable to all kinds of railway stock (com.)—J. A. Forrest and W. W. Hayes. Waterclosets.—A. C. Dingwall. Sewing machines.—C. G. Y. King. Pressure and vacuum gauges.—A. Chiffray. System of printing at the same time one or more colours on both sides of a cloth, and to produce simultaneously some ribs squaring with those colours.—B. V. Benquet. Motor moved by weight.—A. J. Stevens. Steam and other motive-power engines.—W. Young. Electric telegraph apparatus, partly applicable for printing and producing stereotyping and printing surfaces.—J. White. Pistons.—R. Porter. Brake apparatus for wheeled vehicles.—F. Pigall. Scissors.—F. M. Lyte. Industrial manufacture of acetate of alumina, and the treatment of the resulting products (com.)—H. S. Ford. Courier or travelling bag.—J. H. Johnson. Apparatus for disengaging ships' boats (com.)—W. C. Church. Safety and other valves.—J. Bates, J. W. Dixon, junior, and W. Buttery. Apparatus for extracting caps from the base of breech-loading cartridge cases.—J. J. Bodmer. Manufacture of bricks, blocks, and other objects of blast-furnace slag.—J. E. Keirby. Elastic packing for pistons and piston-rods of steam-engines, pumps, rams, and other similar purposes.—E. Quadling and W. May. Machine for manufacturing metal tubes. (Complete specification.)

On November 27th.—3560 to 3573.—G. O. Ogle. Construction of reaping and mowing machines, which improvements are also applicable to land rollers, seed drills, and other agricultural implements drawn by horses.—W. Smith. Looms for weaving.—T. West. Equilibrium steam valve.—J. Ashbury. Seat fittings of railway carriages and other vehicles, applicable also to the cabins or saloons of steam and other ships or vessels.—J. Osborn and G. Nicholas. Locking the wheels of railway carriages.—H. Boxer. Means to facilitate the calculation of the distances covered by each person travelling in any conveyance from any point in the journey to any point in the journey, or for the full journey.—F. S. Foley. Manufacture of collars, cuffs, wristbands, shirt-fronts, and other similar articles.—E. W. Marcus. Means and apparatus for counteracting sea motion in passenger and other vessels, and thereby preventing sea sickness.—W. H. Rodden. Pitchforks (Complete specification.)—J. Dodd and R. Buckley. Mules for spinning and doubling.—E. Ensor. Drying bricks, tiles, pottery ware, and other like goods, and in the means employed therefor.—A. M. Clark. Machinery for grinding and polishing (com.)—A. M. Clark. Combined printing, pressing or calendering, cutting, pasting, and folding machine (com.)—C. F. Bouthorin.—Folding or winding up weft, twist, gimp, galloon and ribbon lace, and similar articles, and in boxes in connection therewith.

On November 28th.—3574 to 3588.—W. Young. Furnaces, grates, and stoves.—T. J. Ditchburn. Machinery or apparatus for the treatment of vegetable productions containing fibre.—C. D. Abel. Artificial fuel blocks (com.)—J. F. Smith. Self-acting gates or sluices and weirs for the prevention of the overflow of water from rivers or watercourses.—A. Wardroper. Umbrellas and sunshades.—R. Hitchcock. Apparatus to be used for removing tubes from steam boilers.—E. Taylor. Shirt collars.—R. Bell and T. Bell. Oil lamps.—F. Burgess and J. Robertshaw. Spinning and twisting fibres.—G. Haseltine. Sewing machines and in mechanism connected therewith (com.) (Complete specification.)—E. Kaulbach. Means of and apparatus for checking and preventing motion on board ships at sea in order to allay sickness.—F. M. Lyte. Treatment and purification of crude phosphoric acid, and in the production of soluble phosphates, also for the manufacture of phosphorus, and the treatment of certain residues resulting therefrom, and phosphate of alumina (com.)—G. Haseltine. Printing-telegraph apparatus (com.) (Complete specification.)—W. Betts. Capsule and machinery for producing the same.—A. V. Newton. Manufacture of sugar, and in apparatus to be used therefor (com.)

On November 29th.—3589 to 3600. E. Burstow. Window-sash stop or fastener.—T. Rowan. Boiler furnaces.—H. J. F. H. Foveaux. Clinical thermometer.—R. Burn, junior. Construction of and mode of actuating the "diamond" and "common" crossings of railways.—L. Ogilvie. Steering ships (com.)—J. Thompson. Shutters for enclosing and securing windows, doors, and other openings.—A. Hughes. Apparatus to be applied to reaping machines. (Complete specification.)—A. H. Davies. Regulator for steam engines.—John Wilkinson, the younger, S. Fillingham, and J. Pardoe, and W. Glover. Machinery or apparatus for scouring, preparing for printing, bleaching, cleansing, and drying worsted, woollen, or other yarns, and for beaming or winding the yarns on to bobbins.—W. Eades and W. T. Eades. Raising and lowering weights.—C. Turner. Scudding, paring, scouring, and removing the grease and dirt from all kinds of split or unsplit skins, roans, goat and calf skins or hides, either untanned or tanned, and for striking out, softening, and polishing dyed or undyed goods.—P. W. Seymour. Magnetic therapeutic plasters.

On November 30th.—3601 to 3618.—G. Hasel-

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Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE.

FEBRUARY 1, 1873.

INDUSTRIAL ORGANIZATIONS.

The "wisdom of our ancestors" is a phrase in these days not too fashionable. Men have now become favourers of the Darwinian theory, and consider their progenitors mentally their inferiors—for this is in accord with the theory of development. If any institution or public custom is good, it is in consequence of having been acted on by modern reform; if bad, it is owing to its being untouched by any innovating hand. Nevertheless, we are surrounded by political and municipal institutions which are our pride and the envy of the whole world; amongst these trade guilds take no mean rank. Originating as associations of men following one common art or commercial avocation, they aimed at supplying a public want—the organization of industry—in the most comprehensive and practical manner. They were no mere trades' unions of the modern kind, associating the workmen for the maintenance of their interests, separate from that of their employers, for they embraced masters, workmen, and apprentices in one society, all working in connection with the ordinary magistracy of the country with the view to uphold the status and watch over the interests of each branch of industrials. Such was their pristine state, though their present position is, it must be confessed, but a shadow of that they formerly held. Some have died out altogether, and others have "a name to live but are dead," whilst a few are endeavouring, like the Turners' Company, to revivify themselves, and not altogether without some success.

It cannot be doubted by any observant person that institutions of the same general character as the ancient trade guilds are capable of doing as much good service to the country as they have in time past proved injurious to industrial progress. It is true they, having in former times been guilty of acting upon narrow views of sectional trading interests, limiting production and checking the growth of commerce, which, according to the system, they practically adopted was to be allowed to develop only in such a manner as appeared to each individual guild to be advantageous for its own interests. But between the two extremes of narrow-minded meddlesomeness and absolute non-interference is situate the *via media* of judicious intervention on all questions where the ignorance or cupidity of individuals or sections may be likely to be productive of injury to the entire craft or the whole industrial body.

Thus, to take the case as it at present stands, putting aside the advantages to the progress of invention as advancing trade which these guilds could offer, we have the evil effects of ignorance of technical science which exists amongst so many men engaged in industrial pursuits, as a matter requiring to be dealt with by the establishment of suitable arrangements for the promotion of technical education, and one which it should be the business of these guilds to take in hand. We have also the question of prevention of "strikes" and "lock-outs," which is clearly a work germane to their professed character and constitution—matters neither small nor merely sectional, but of the widest public importance.

It is clear, therefore, that there is plenty of work for the guilds to do, and work that promises much national advantage. This question being disposed of, another one has to be dealt with —namely, are the guilds in their present state equal to the requirements of the case, for as far as those of our metropolis are concerned, and they are the only bodies now existing (with a very few provincial exceptions) worthy of being taken into account in dealing with this subject. These bodies are for the most part composed of men who do not carry on the trade or vocation ostensibly organised in the guild to which they belong. But instead of regarding this state of things as an objection to the adaptability of the guilds, to the work referred to, it should be considered as advantageous to it, since they now possess bodies of men who, being outside the crafts or vocations they have to operate upon, will, it may be fairly assumed, possess no trade bigotry or narrow views as to the policy that ought to be pursued for the benefit of such crafts or vocations, and any technical or trade knowledge they may require they can readily obtain by recruiting their ranks by the addition of men who are actually practising the craft.

As definite propositions are always preferable to mere generalities, it may be desirable to present a few suggestions on this subject for the consideration of the public, and we cannot do better than place before our readers the suggestions made by Mr Campin in his paper on Trade Guilds recently read at the Inventors' Institute.

First, then, these guilds should establish periodical exhibitions of works of art and industry, and should award money prizes and also the freedom of the company to the high-class prizemen.

Second, they should support free academies for instruction in technic science, and offer inducements to youths and others to become students in them by awarding prizes (freedom of the company to be amongst these) for technical merit, and even for regular attendance with orderly behaviour, for in the first instance at least it will be found that youths will have to be offered the opportunity of obtaining payment for attendance at these academies.

Third, the guilds should require that all their apprentices pass examinations in technic science, awarding them certificates and prizes if entitled to them.

Fourth, the guilds should form councils of conciliation for the prevention of strikes and lock-outs, and the regulation of the dealings of the members of the craft.

Fifth, they should award emblazoned testimonials to masters, whose apprentices or workshop youths have obtained good prizes or certificates.

Sixth, each guild or group of guilds should award prizes for good practical inventions which have reference to the art or industry appertaining to such guild or group.

Seventh, for the better carrying out of these suggestions it is desirable that all those persons who are practising a trade or craft, but are members of another guild, should be admitted *ad eundem* to the freedom of the proper guild without cost if willing to serve on committees for promoting technical education and progression of the craft and councils of conciliation.

The indentures of apprenticeship to any such members of a guild who are following some other craft or vocation than that appertaining to the guild of which he is a member, should be notified by that body to that one to which his craft does appertain, and when the term of his indentures is completed, he should become a licentiate of the proper guild for his trade or art liable to serve on its technical committees and councils of conciliation. And any workman or apprentice, according to the discretion of the guild, should be admissible as licentiate of that guild.

The term licentiate as here used must be taken to mean that the person is certified as capable of carrying on his trade, and will not be hindered or molested by the guild belonging to the trade in so doing.

It must be remembered that in all these suggestions the guilds or companies of the City of London have been those principally had in view for the reason above adverted to, and it must be remembered that the members of these companies are not obliged to reside or carry on business in London, and that the jurisdiction of most of them extends beyond the City bounds, some even embracing all England. Further, that under the presidency of the Lord Mayor they can act in concert, and thus they might form local committees for some or all of the objects above referred to, and a national technical university, or what appears to be more desirable, a Royal academy of technology (to take rank after the present Royal academies), with affiliated institutes might be evolved from any such movement on the part of the London guilds.

Reviews.

On the Construction and Manufacture of Artificial Limbs.

By THOMAS WELTON, 13, Grafton-street, W., Fitzroy-square. London. Published by the Author.

ALTHOUGH this, like many other pamphlets now issuing from the press, is evidently intended as a means of advancing the author's professional interests, yet, as it affords some sound practical information on a subject of the first importance to those unfortunate members of the community who are compelled to resort to the use of artificial substitutes for natural limbs, we feel it a duty to humanity, as well as practical science, to notice this little work in our columns.

Though full of practical points, the following hint to the surgical profession is, perhaps, the most important one in the book.—

It is not intended in this small work to offer advice to the surgeon as to where it is best to amputate, as it would be insolent, for I presume that he knows his business best and would not thank me for it, but I content myself by remarking, that if the leg be amputated too near the ancle joint, it is very difficult to fit an artificial foot to the stump. First, because it would not have sufficient flesh at the end to well cover the bone, and next, because the stump being long would occupy the space required for the ancle joint of the artificial foot, and be very unsightly when the leg is finished, as the ancle joint of the artificial should correspond with the natural foot. I know of such a case in Hammersmith, in which the patient underwent Chopart's operation, and no man in England can fit him so that he can walk with comfort, to try to do so, has cost him very many pounds. The instrument before described that I made for him, being very light, is the nearest fit, and the one he wears. I could cite other similar cases abundantly proving my observations.

Mr Welton gives a brief history of the various patents that have been taken out in England for artificial limbs, with their dates, names, and numbers, which will doubtless be interesting to our inventive friends.

In the year 1790, the first patent taken out for artificial limbs, is by Mr Mann, No 1724. The second, by Mr James Potts, in 1800, No. 2418. I give an abridgement of the specification "An artificial leg on a new or improved construction. A box or tube of bend leather is fitted to a wooden joint, several inches thick, in which there are stops to prevent its movement going beyond a certain point, and a lock which fits to the under lock of the knee, a piece of wood. When stuffed after the form of a natural leg, the lower end having a virl and ball (cup and ball joint) which are inserted into the brass sockets of the wooden foot, furnished with screw-nails, and nuts, the toes of the foot are also jointed and capable of motion." In another specification, the patentee claims the right of enamelling, japanning, or painting artificial limbs of a flesh colour. It can be clearly seen that the celebrated Bly leg, which received provisional protection only, is not an original idea, nor the much vaunted enamelling of it either, and, in fact, J. Pott's leg is a much more shapely one, if that be any advantage, than Bly's, though heavier in weight; but when it is taken into consideration that Bly's foot is weighty just where it should not be, it is doubtful if it be not the heaviest to wear, and indeed, the same may be said of the new American leg, with its mass of India-rubber in the foot. Three of my customers cannot wear them, though so much bepraised.

Does it not stand to reason, that the whole of the lower part of an artificial leg or foot should be light, to give the wearer a better chance to use it?

Mr. Bly also claims as new, an improved knee-joint for cases of amputation of the foot. His supposed improvement has been in common use by Mr. Grossmith, of Fleet-street, for several years past. See his show card as proof. Having said thus much without any desire to detract from any person's merit, but simply to state the truth, I think it would be as well to say that there are in common use two recognized artificial legs, one usually called the Anglesea, which consists of a wooden thigh case having ordinary mortice and tenon joints at the knee and ancle; both these joints have a hollow bolt passing through their centres. To give motion to the foot, a strong piece of gut is affixed to the heel, passes through the calf and is attached firmly to the back of the knee. India-rubber bands are also affixed, both to the front of the ancle and the front of the thigh case, to give the requisite motions to the instrument, which when well made is really a clever piece of mechanism, but needs attention, as does also a steam-engine, or any other machine subject to wear and tear.

The other one, named after the inventor, Mr Palmer, is lighter than the Anglesea, cleanly in appearance, light to walk with, has a firm natural step, is japanned a flesh colour, and so can be washed and is much to be commended for its ingenious arrangements, especially of the foot, which is hollow, having a bolt connecting the foot and ancle joint which is so constructed that the heel fits into the back part of the leg, and the front part of the leg (at the ancle joint) fits into the front part of the foot hollowed out to receive it. This arrangement is very clever, neat in appearance, but of necessity weak, and, of course, liable to get out of order, and I may add that is its only fault, and now allow me to say, that the prying of the stump against the sides of the thigh case is not the result of the want of lateral motion of the foot as stated by Dr Bly but the absence of skill in the construction of the instrument (the result of misfitting in plain English), though I admit that his foot in that respect is anatomically right, but mechanically wrong, because of its weight in the wrong place as before stated. Having said so much respecting the artificial limbs now before the public, I continue the list of patents respecting them, so that without trouble any person may judge of their merits, premising that in my search I may have unintentionally omitted some.

Mann, 1790, No 1724, Mann, 1810, No 3398, Shand, 1816, No. 4059, Wilms, 1817, No 4116, Brooman, 1849, No 12 444, Mitchel, 1852, No 204, Salt, 1855, No 1220, Ashman, 1856, No 1751; Jones 1856, No 2835, Newton, 1857, No 750, Michel, 1860, No. 675, Masters, 1862, No 1862, Newton, 1862, No 1185, Newton, 1867, No. 63, Brown, 1867, No 2957; Bigg, 1868, No 3973.

It is useless to review the whole of these patents, suffice it to say that no doubt all of them possess merit as steps towards the right direction, still practice and acquaintance with the art proves which are best, and I have no hesitation in saying that the Anglesea leg is so, all things considered, but it often happens, that the workman in the exercise of his profession sees an improvement (and most commonly holds his tongue about it for evident reasons), that his employer fails to perceive, because their aims are different. The workman's heart is in his labour if he be a man at all, the employer's aim is how to increase his profits, and rightly too, providing they are fairly and honestly obtained.

Twelve Months' Experience with the A B C Process of Purifying Sewage.

A Letter addressed to a Shareholder in the Native Guano Company (Limited). By WILLIAM CROOKES, F.R.S., &c. London. 1872.

ACCORDING to Mr. Crookes the claims of the A B C process to public confidence are, in the opinion of its promoters, threefold.

I. It deodorizes and disinfects sewage, and precipitates the suspended and much of the injurious dissolved matter in it; without giving rise to any nuisance, it converts the deposit into a dry, portable, and inoffensive powder, possessing considerable manurial value.

II. It leaves the effluent water in a state of practical purity, fit to be discharged into any river.

III. It effects these important sanitary requirements at a cost, which not only relieves the ratepayers of expense, but even yields a profit, owing to the ready sale of the "native guano" at £3 10s. per ton.

Mr. Crookes examines the three statements *seriatim*.

First, the precipitation of the "native guano" from sewage. When I first heard of the process, the mixture of alum, blood, clay, and charcoal appeared irrational. I assumed, as most chemists would, that the alum did most of the work, that the charcoal might perhaps assist in removing smell, but that the clay and blood were, if not actually injurious, at all events inert. It was not until I had worked for some time both in the laboratory and on the large scale that I saw how judicious was the mixture which had at first appeared so incongruous. It is true that the alum or sulphate of alumina does a great part of the work. In contact with sewage—a slightly alkaline liquid charged with nitrogeneous organic matter—the alumina is separated in flocks, and by virtue of its remarkable affinity for dissolved organic matter each particle seizes hold of, and drags down with it, a corresponding particle of nitrogeneous impurity. The blood here comes into play, this is essentially a liquid highly charged with albumen, albumen is instantly coagulated in the presence of alum, and in the same way as this ready coagulability of albumen is utilized in fining wine and coffee, so it is made use of in this process, by joining with the alumina in its precipitation, uniting it in a net-work of fibres, and giving it, as it were, arms wherewith to seize upon and drag out of the liquid still more putrescible constituents.

But the precipitated hydrate of alumina is light in character, and although it would ultimately settle, leaving a clear liquid above it, the slightest agitation causes it to float up, and thus renders it difficult, on the large scale, to drain off the mud. At Paris I have seen sulphate of alumina, *per se*, employed for clarifying several hundred thousand gallons of sewage, and among the many defects of this process, that of imperfect settlement was by no means the least. Here the action of the clay is apparent. This substance has a curious physical property; when finely ground up with water it forms a creamy emulsion, which takes many days to settle, many rivers, in time of flood, owe their turbidity to this cause; the Seine at the present time is a striking example, its water being in colour, although not in actual impurity, as bad as the Thames below London Bridge. But when this creamy liquid meets with sulphate of alumina, the clay coagulates like albumen, and settles down in heavy granular flakes. Now in the A B C process these three precipitations—that of the alumina, that of the albumen, and that of the clay—take place simultaneously, and in each other's presence; they become closely locked together in a triple alliance; the heavy character of the clay particles gives density to the mass, and causes it to settle rapidly, and remain in a compact form at the bottom of the tank.

Were the object merely to produce an easily dried precipitate and a clear effluent, nothing more would be required; for not only has this precipitate carried down all the suspended matter, but much of the dissolved nitrogenous and albumenoid impu-

rities have fixed themselves on to the alumina, whilst the clay has also performed its part in absorbing and carrying down a good proportion of the ammonia. But there still remains the probability, if not the certainty, of foul gases being present, whilst the water, though clear, may nevertheless be coloured. These residual impurities are attacked by the charcoal; the powerful affinity of animal charcoal for organic colouring matter corrects the one evil, whilst the well-known absorptive action exerted by vegetable charcoal on the gaseous products of putrefaction corrects the other. Little more in the way of purification remains to be done.

By a modification in the order in which the purifying ingredients are added, these reactions, which I have explained somewhat fully, are effected at once, with a certainty of uniform results, whilst by a simple mechanical arrangement the exact dose of each constituent required by a variation in the strength of the sewage can be readily added.

The drying of the mud is more an engineering than a chemical problem, and a very tough one it seemed to be for the first six months of my connection with the Company. A most ingenious application of heat in revolving iron cylinders has, however, solved this difficulty. Wet mud is poured in at one end, and dry manure in the form of an inodorous and inoffensive powder falls from the other end, at the rate of 5 tons in 10 hours, at an expenditure of a few cwts. of coal. If space enough be available the mud may be simply pumped from the bottom of the settling tanks into large open-air tanks, where it gradually dries up under the influence of the sun and air not the slightest offensive odour is apparent during any stage of this drying.

The second point which demanded attention was the state of the effluent water As to this Mr. Crookes says It is perfectly limpid and colourless, and has no smell, and so little taste that were it not that the tasters know whence it comes they would not notice it.

Mr. Crookes next refers to manurial value and finally concludes thus. -

I have, therefore, no doubt that under proper management the A B C process can be worked so as -

1. To deodorize and disinfect all collections of town sewage, solid or liquid.

2. To produce an effluent water fit to be discharged into any river

3. To produce a dry, portable, and inoffensive manure, readily saleable to agriculturists at £3 10s. a ton.

4. To effect these without any nuisance, and at a cost of not more, and probably much less, than £2 a ton.

On the Advantages of Gas for Cooking and Heating. By MAGNUS OHREN, A.I C E., Past-President of the British Association of Gas Managers, Secretary of the Crystal Palace District Gas Company London Printed for the Author, by M'Corquodale and Co., 6, Cardington-street, London, N.W.

THIS little pamphlet is worthy of the attention of all those who are interested in the application of gas to cooking and heating purposes, as it contains several wood engravings, accompanied by explanatory remarks, which afford a considerable amount of information as to various stoves and apparatus which are now before the public, and is well worthy of perusal by all practical men, though the work is intended for distribution among gas consumers, and is to convince them, by a thorough investigation of the subject, that gas cooking and heating stoves are now brought to a state of great perfection, and may be used in lieu of coal fires, with much advantage. The requisite information is given to guide them in the selection of suitable stoves, and in districts where gas companies do not at present sell stoves or let them on hire, any gas fitter or ironmonger can supply those named in this pamphlet, *at the prices quoted:* but should any difficulty be experienced the makers will, on receipt of a post card, give full particulars of where and how the various apparatus may be obtained. The author says in the preface.

"Amongst other apparatus used or inspected by me may be noted, the "Cheerful Gas Fire" lately introduced from France, representing (by reflection) a blazing fire this stove can be obtained through Milne and Son, of King Edward-street, London, and Edinburgh* - the stoves are made of various shapes, and of sizes *suitable for existing fireplaces.* The cooking apparatus made by Green, of Western-road, Brighton. The "King of Bar Stoves," specially designed for taverns, refreshment bars, &c., made by Michel, of Oxford-street, London. "The Bath Stove," made by Phillips and Son, of Barbican, London, the original makers of gas baths. The "Kitchen Boiler Protector," patented by Waterson and Co., of Forest-hill, Kent made by Hulett and Co, of Holborn, London this gas stove is simple, effective, and cheap, any plumber can fix it it prevents the exploding of kitchen boilers, and can be used to prevent the bursting of water pipes during frosty weather. And last, though not least to be noted, "The Self-Purifying Stove," just patented by Dr. Tayler, of Norwood, specially designed for warming the bed rooms of invalids made by Hodge and Co, of Hatton Garden, London.

The author adds

Let me impress upon those who intend using gas stoves that it is useless to go to the best makers, and get the best stoves, if the chief point, the quantity of gas recommended to be used with each description of stove, be not *rigidly attended* to, as *too much* or *too little* gas will prove a failure, for this reason I urge the use of gas regulators, and to insure a perfect supply, a regulator should be used to each stove I find that for stoves consuming about five to eight feet per hour a lamp regulator (the same as used to regulate public lights) is quite sufficient John Wright and Co., of Birmingham, at my suggestion, are fitting them to some of their stoves (at an additional expense of about 4s) they are easily fixed, give the requisite quantity of gas under varying pressures, and are self-acting Dry gas regulators of all kinds are made by William Sugg, of Vincent Works, Westminster, London, who will give consumers every information respecting them, if there be any difficulty experienced in getting them from local gas fitters I recommend *dry* in preference to *mercurial* regulators for safety

With well made stoves, and the supply of gas properly regulated, the use of gas stoves will soon become universal.

Cooking by gas, which now appears so easy, and is so satisfactorily accomplished, is the result of many years experience, and it is only within the last two years that the cooking stoves, introduced by Mr Ohren, have been in full operation in the district lighted by the company of which he is secretary, to the great satisfaction of a large number who use them, and it is to make known the value of these stoves, and extend the use of them, that this pamphlet is published.

Perhaps the most interesting part of this pamphlet is the description of a stove fixed by Mr. Leoni at the London Hospital, and which Mr. Ohren states gave astonishing results, the object to be attained being not how to obtain light, but *how to obtain most heat,* in a convenient form, from the least consumption, and the *great secret* of the process consists in burning the gas with a certain large admixture of atmospheric air.

As the comparative economy of the process is more strikingly shown on a large scale than a small one, I shall give some details of the apparatus at work at the London Hospital, and conclude with a report of Mr. Nixon, after about six months' experience of its use. The cooking for a large hospital is no unimportant element in the daily expense; it presents fair opportunity for comparing, not on speculation, but from carefully-considered data, *i.e.*, the record of a series of facts extending over a lengthened period, the result of certain processes which may be seen at work any day.

The number of dinners to be provided every day is about 650; but I have the authority of the "*cook*" for saying that, with the same apparatus, dinners daily for 1,000 people could be easily provided.

The kitchen of the London Hospital is, of course, in the basement, and the first and most important item of its requirements is the roasting apparatus; this is below the floor-line, and covered with a chequered plate, flush with the floor, so that while the dinner is cooking there is no evidence of what is going on, except a certain simmering sound, the temperature of the room not being above 60 deg in ordinary weather. A more extensive application of the method of cooking is all that is required.

The diameter of the cylinder is four feet internally, and five feet externally On the day of my visit 239 lbs. of meat had to be roasted, the joints were suspended on horizontal spits to a light wrought-iron frame, and at twelve o'clock, after exactly two hours in the stove, the lid was raised, the crane turned round, and the frame, with the joints perfectly cooked, quietly lifted from the cylinder, and carefully weighed to ascertain the per-centage of waste in cooking, as they were previously weighed before being "put to roast" a few minutes only being required for the operation. A small iron staircase leads down to the dripping-pan, which, of course, has to be cleaned every day, but, with this exception, the whole of the work is done at the floor level. An apparatus of this size will roast 5 cwt. of meat in two hours, if required. There is an ingenious arrangement for a single or double supply of gas, the double supply is used in the earlier part of the cooking, and the single one afterwards. The consumption is about 250 ft. in two hours

In case of small roasts being required, there is above the floor, and somewhat resembling an iron safe in its outward appearance, a double roasting cupboard, 6 ft high, in two heights, each height having its separate gas-ring, in which a few joints can at any time be cooked in case of need

So much for the roasting now for the boiling, frying, and baking The two first of these processes are conducted at an adjoining hot-plate, with what may be termed "open gas fires," fourteen in number and varying from 12 to 8 in in diameter They are contained in an iron frame 8 ft long 2 ft 6 in wide, and 3 ft high, the products of combustion are removed in this case by flues of wrought iron into a common chimney Upon the openings in the top plate of this gas stove, as it may be called, any number of boilers, kettles, or other vessels may be placed, and the heat can be regulated according to the work to be done, each circular opening having a double ring of gas jets, the inner and outer circle each controlled by a separate tap ten of the fourteen openings are thus double, the remaining four smaller and single. *Broiling* is done by reflection, with similar arrangement of burners a series of six trays, each 20 in by 12 in, sliding in a few inches under the gas-rings. Each of these trays will cook twenty chops if required in the course of a few minutes.

The baking is done in the oven adjoining, [illegible] in this case the [illegible] and the sides of the [illegible] 6 ft. high, 3 ft wide, [illegible] ft. below the [illegible] to be baked. The pies are arranged on [illegible] five wrought-

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*I find that these stoves are now manufactured in England by Messrs. Wright and Co., of Birmingham.

iron open light shelves, which occupy the upper portion of the 6 ft. in height, to which these ovens extend. About fifty pies at a time can be baked in each of the two ovens, the time varying, of course, from that required for meat pies to the few minutes necessary for light puddings, but all these details are matters of absolute practice and calculation. In all these cases ample provision is made for removing the products of combustion without loss of heat.

As an intermediate application of the principle, I might instance the Governor's house at the London Hospital, where the same apparatus is employed in a modified and combined form, suitable for a large private residence, mansion, or hotel. The dimensions are 5 ft. long, 3 ft. high, and 2 ft. deep, and might cook a dinner for 100 people.

Prize Essay on the Balance Spring and its Isochronal Adjustments. (Baroness Burdett Coutts's Prize.) By MORITZ IMMISCH. London: E. and F. N. Spon, 48, Charing Cross. New York, 446, Broome-street.

THIS is an essay well worthy of the prize it obtained, and we cannot do better than let the author speak for himself. He truly says: "The Balance Spring has often been called the soul of portable time-measuring instruments, and anyone at all partial to figurative language will own that it fully deserves the appellation, inasmuch as from its importance, delicacy, sensitiveness, and independence of action, it may well be likened to the predominating mind which, though it derives its sustenance from the body, governs in its turn all the actions of the latter. Watchmakers are all the more tempted to make a comparison of this kind on account of the uncertainty under which the majority of them labour with regard to its properties and the laws which govern its actions.

One can scarcely be surprised at the prevailing ignorance in this respect, as there is very little reliable information to be found in books on watchmaking which could at all serve as a guide, and as a sound base for self-improvement.

The principal aim of watchmaking is correct measurement of time, and it must be confessed that in this respect, judging from the average performance of what are called first-class watches, there is ample room for improvement. There is no doubt that a proper knowledge of the nature and correct adjustment of the balance spring, especially with regard to isochronism, is of the utmost importance.

This manifests itself very strikingly when we see that frequently a watch or chronometer of inferior make and even faulty construction goes admirably, and with a regularity which in some cases is perfectly astonishing, while, on the other hand, the highest degree of perfection of the escapement, the most exquisite finish of the trainwork, is unavailing to produce good performance if the balance spring is faulty or imperfectly adjusted.

It is to the introduction of the balance spring that watchmaking as an art may be said to owe its very existence.

There certainly was a kind of watch made before its invention in which the vibration of the balance was kept up by the recoil it met with in the escapement, the momentum of the balance being alternately destroyed and renewed solely by the direct operation of the motive force. This mode of obtaining a vibrating motion was no doubt extremely ingenious, but it is evident that any of the unavoidable irregularities to which the available impelling force of the fly-wheel is always subject would tell immensely upon the balance, modifying its speed to such an extent as to make these watches next to useless for practical purposes. The principles upon which these machines were constructed, precluded the possibility of their being materially improved, and they would have remained, what in fact they were then, objects of curiosity rather than of utility.

It was reserved to the genius of the celebrated Dr. Hooke, who in the middle of the seventeenth century discovered the use of the balance spring, to supply the wanting elements of perfectibility, and to raise watchmaking from its primitive state to the rank of a beautiful and beneficial science.

His keen intellect perceived at once the immense advantage of giving to the balance an independent motion of its own, by means of which it was enabled to exercise a proper control over the irregularities of the motive force and to neutralize their effects. His scientific investigations of the nature of springs, and his inquiries into the laws that govern their action, led him to his celebrated maxim, "*ut tensio sic vis*" (the force of a spring is as its tension), that has made his name famous for ever. With a view to solve the problem of determining the longitude at sea by means of a correct timekeeper, he applied for a patent, it was not carried into effect, however, on account of a serious disagreement between him and some enterprising gentlemen of position, in conjunction with whom the Doctor intended to work the patent at first, and he determined to leave the matter dormant for a time. It soon transpired, however, and "pendule watches" were made by several watchmakers in London soon afterwards. We find, too, that later on, several French watchmakers were quarrelling amongst themselves about the priority of the same invention, but this can only mean the priority of application, inasmuch as from documents still existing it appears that some of them had been in communication with the same parties who had failed to come to terms with Dr. Hooke, and it is more than probable that they suggested the idea to their French correspondents.

Considering time and circumstances, the beautiful combination of balance and spring must be put solely to the credit of Dr. Hooke.

Applied to the old verge escapement, the difficulties in the way of good performance were still very great on account of the recoil, but as this could now be dispensed with as a means of bringing the balance after a first impulse back into a proper position to receive the next, the idea of dead-beat escapements suggested itself, and Hooke contrived one which, though it had still a slight recoil, contained the elements and was suggestive of the duplex escapement which was invented some fifty years later by Dutertre, a French watchmaker.

In the course of time a good many of these escapements came into existence, but it was not until the free detached escapements made their appearance in the latter part of the eighteenth century, that the real properties of the balance spring could at all be tested with any chance of arriving at some definite conclusions.

Before that time the greater or lesser friction of the acting parts of the escapements continuing throughout the whole of the vibration made it a matter of great perplexity to reconcile the results actually observed with Hooke's "*ut tensio sic vis*," and as the theories founded on experiments with one escapement were at variance with the results of experiments made with another, we cannot wonder that the opinions concerning the spring were undecided and sometimes contradictory.

As an instance illustrative of the extreme difficulties in the way of properly understanding the conditions under which the balance spring acted, I may mention that in 1766, more than a hundred years after Hooke's invention, Cummings, in his book "Improvements of Watchwork," describes a dead-beat escapement, and in experimenting with it finds that its behaviour in long and short vibrations was so different to what it was with other escapements that he comes to the conclusion "that hitherto the effects of the maintaining power have been mistaken for the natural tendency of the pendulum spring."

(To be continued.)

Gregory's British Metric System: A Complete Non-Decimal Assimulation of the British to the Metric System of Weights and Measures, Retaining their Present English Names. The Two-Foot Rule made Metric, with Metric Duodecimals; Equivalent International Prices, without Decimal Coinage. For Adoption in Great Britain and the United States, the British Colonies and India. By ISAAC GREGORY, Principal of Merchants' College, &c. London: Cassell, Petter, and Galpin; Paris: Hachette, et Cie.

THE object of this work is to present the public with a practical plan of rendering our weights and measures metric, and to afford the advocates of the metric system ready means of facilitating its practical introduction. The work contains full descriptions of the New Metric Measures, British Metric Tables, Comparative Metric and Imperial Measures and Equivalent Difference in Price for Difference in Measure, Comparative Quantities in the Tables, Dissertations on Prices, Pieces of Goods, "Picks" or Threads, as affected by the Metric System, and on Arithmetic and Metric Coinage.

The Weight of the Sovereign. On Gross Weight, Nomenclature, Series of Weights, Examples in Gross and Jewellers' Weights, Series of Liquid and Dry Measures, Dimensions of British Metric Measures, the Centner, Bushel, Quintal, Quarter, Remarks on Examples in Liquid and Dry Measures, Equivalent Prices British and Metric. And as to Metric to English, English to Metric Money. The Two-Foot Rule metricised is described by reference to an Illustrative Diagram and Equivalent Measure, the Metric Two-Foot Rule and Metric Duodecimals with Examples, Metric Square and Cubic Measure are fully discussed.

The following statements as to the origin of the Metric System will interest many of our readers.

The animated discussions arising from the opinions first expressed by Sir Isaac Newton, that the earth became flattened towards the Poles, caused the scientific men of France, under the direction of the great Colbert, not only to examine and verify Sir Isaac Newton's opinion, but to propose a new measure of length. Mouton in 1670, and Cassini in 1718, suggested a decimal division of a terrestrial degree, as a unit of length. In 1766, commenced in France the first serious step towards the uniformity of weights and measures, required in France for so long a period, and still urgently required in Great Britain. A decree of the National Assembly of France, 8th May, 1790, urged the King of France to concert with the Government of England for a *reunion* of scientific men to make investigations, having for their object the deduction of a natural and invariable standard for all weights and measures.

Political events, war, and unfortunate national animosities prevented our concurrence; but, under the Academy of Sciences, a European commission was formed and committees, consisting of almost all European states except Great Britain, assembled. They carried on the work from the 24th June, 1792, under Mechain's and Delambre's leadership, and after seven years' laborious work, the two appointed committees completed their labours. The commission, composed of twenty-two scientific men, as many foreign *savants* as French, fixed upon the ten-millionth part of the distance from the North Pole to the Equator, as the great unit, to be called the meter. Lenoir constructed the various standards of length; Fortin constructed the unit of weight; and Lefevre-Gineau the unit of volume. The metric system was declared legal on the 10th December, 1799. It was rendered obligatory and exclusive in 1801,

but the Government, owing chiefly to their having changed the old nomenclature entirely, and their not having taken any steps to convince the popular mind of the equivalent differences in money and quantity between the old and new measures, the new system made little progress. The law of 8th February, 1812, permitted the manufacture and use of non-metric weights and measures, based upon the new system. These are still much used in France, although since January 1st, 1840, the metric system, only, is exclusively obligatory. The nomenclature of the metric system has proved a constant misfortune. The popular mind prefers monosyllables to and distinctive names for measures, the pedantic polysyllables of the new system have, therefore, always obstructed its progress and popularity. Moreover, the coinage was changed at the same time, and it is self-evident that fractions of a unit of weight and measure, at fractions of a unit of money, was, and is, an unfortunate combination. For example 25 centimeters of an article for 30 centimes would disturb a mind to which both centimeters and centimes were equally strange.

Mr. Gregory deserves the thanks of all rational men for this very practical effort to reduce our present chaotic system to a reasonable condition.

The Mineral Surveyor and Valuer's Complete Guide; Comprising a Treatise on Improved Mining Surveying, with New Traverse Tables, and Descriptions of Improved Instruments; also an Exposition of the Correct Principles of Laying Out and Valuing Home and Foreign Iron and Coal Mineral Property. To which is appended the Second Edition, Carefully Revised, of M. [illegible] of the Societé Credit Medal of Paris [illegible] Treatise on Compound Interest and Annuities with Logarithmic Tables. By WILLIAM LINTERN, Mining and Civil Engineer. With Four Plates of Diagrams, Plans, &c. London: Lockwood and Co., 7, Stationers' Hall Court.

THIS is a most useful practical work, containing much general and technical instruction as to Paper for Maps, Dividing and Joining the Paper, Meridional Lines, the Chain Chaining, &c., the Field Book, Entries, Points, &c., Traversing, the Traverse Tables, their Construction and Application, Improved Dial and Protractor, Plotting the Survey, the Business and Application of Surveying. On Triangulation, &c., on the Valuation of Mining Property, and on Traverse Tables.

A Budget of Paradoxes. By AUGUSTUS DE MORGAN, F.R.A.S., and C.P.S. of Trinity College, Cambridge. Reprinted, with the Author's Additions, from the "Athenæum." London: Longmans, Green, and Co.

IT would be superfluous to do more than notice the publication of this work. The late Professor De Morgan's high reputation is so wide-spread, and these particular works of his must have already become so well-known in their serial form, that nothing is left for us to do but to chronicle the issue of the book from the press, but we may add that every man of science ought to have a copy of the work in his library.

Lectures on the Philosophy of Law; Together with Whewell, and Hegel, and Mr. W. R. Smith. A Vindication. By JAMES HUTCHINSON STIRLING, F.R.S.S., and LL.D., Edin. London: Longmans, Green, and Co. 1873.

THIS is a small book containing a *resumé* of nearly all that has been said, and can be said, on this subject, very interesting though metaphysical it be. Our space, however, will not permit us to review its pages in detail, therefore we must refer all who feel interested in the matter to the work itself.

The Astronomical Almanack for 1873. By H. W. HOLLIS, PhD., F.R.A.S. London: Simpkin, Marshall, and Co., Stationers'-Hall Court; Newcastle, Staffordshire, D. Dilworth. 1873.

THIS is a little work that will be found very useful to all interested in astronomy. In it the following particulars are given for every day in the year:—The Equation of Time, Sidereal Time at Mean Noon, Moon's Age at Midnight, The Configuration or Position relative to each other, and to the planet of Jupiter's satelites (when visible) and many other matters of interest to astronomers.

Songs for Sailors. By W. C. BENNETT. Henry S. King and Co., Cornhill.

ENGLAND is rich in sea songs, and some of them of the very highest order, and these may take a prominent position amongst them, for they are sensible, manly, and spirited. Dibdin's, which are, perhaps, better known than others, are for the most part not songs for sailors though many of them possess every good quality requisite in such effusions. In their rhyme there is the measured roll of the ocean, and in their natural *abandon* the freshness and vigour of the sea breeze. There are many single compositions, however, such as the "Arethusa," by Prince Hoare, which are far greater favourites with our sailors than even the best of Dibdin. Mr. Bennett's little volume now published is really an admirable effort to [illegible] the glorious deeds of our sailors an[illegible] place in the memory of our [illegible]. It is a pleasure to sing aloud what [illegible], and, as a rule, we love what we [illegible].

Harold Erle. A Biography. By WILLIAM [illegible] GIBBS. [illegible] and Co., Henrietta-street.

THIS is a second edition of Mr. Gibbs' poetic [illegible] story, and it may be taken as an [illegible] of an improvement in public taste that this new issue of [illegible] unpretending, yet so interesting, a volume has been called for. "Harold Erle" is noticeable for its want of resemblance to the most pretentious poems of the day. There is in it no violent situations, no widely abrupt transitions, no bewildering, half insane rhodomontade. On the contrary, the story begins quietly and proceeds to its termination quite naturally, depending entirely for its interest on the truth to life and nature with which it is worked out and the beauty and appropriateness of the language and images employed. We could quote many passages to justify this judgment, but like some of the very best poems we possess, no single part can give an adequate conception of the whole as a pleasing, graceful, and able performance. The blank verse flows naturally and easily, and the few lyrics scattered here and there through it make known the power of the writer, and beget in the reader a regret that Mr. Gibbs does not more frequently give us an opportunity of enjoying such gems of song as this volume contains.

Memoirs of Baron Stockmar. By his son, E. VON STOCKMAR. Translated from the German by G. A. M. Edited by F. Max Muller. 2 vols. Longmans.

To those who like to look from the social side of our politics into the minor mysteries of political life, this pleasant book will afford considerable help. Baron Stockmar born in 1787, became a skilful physician, and in that capacity was employed by Prince Leopold, of Coburg, to attend on his person as medical adviser. Being personally respected and much trusted by his master, who had been chosen to fill the throne of Belgium, he became the chief adviser of that sagacious sovereign, and was ultimately commissioned to the English Court as the confidential adviser of our Queen—not then married. Being a thorough German, he did all in his power to promote the union of the young Queen and Prince Albert; and when the Queen had notified her approval of the Prince, Stockmar set about fitting him for the new honours he was about to receive. He remained many years at the English court, and only retired when age must have made such a life troublesome. He seems to have been an honest, good-natured man, who, notwithstanding his knowledge of Courts, never lost a hearty trust in his fellow creatures, nor did he at any time allow himself to doubt that his native country, by a wise unity, would some day become one of the foremost nations in the world. The life of this observant and honest courtier furnishes a great variety of topics for consideration, and by his correspondence occasional side-lights are thrown on obscure passages in contemporary history which add much to their interest. Amongst other things he deals very minutely with the struggle in the House of Commons between the Liberals and the Tories as to whether the annual allowance of Prince Albert should be £50,000 or £30,000 per annum. The Tories, through the bad management of the Whigs, as Baron Stockmar thinks, succeeded in striking off the £20,000 moved against by Colonel Sibthorpe, and thus set an example of economy which is more than likely they have not been very proud of or anxious to follow since. However this may be, there is much in the Baron's book which English readers will find it pleasant to run through, whilst to the political student it will be of great value as a key to open the way to a consideration of Court politics, useful in helping the study of those weightier questions of national policy which occupy the attention of statesmen and politicians.

A Lady of the Last Century. By Dr. DORAN. Richard Bentley and Son.

THIS is really a most interesting volume, and in certain senses instructive. Mrs. Montague, who is the subject of it, lived at a time when the oddest people were in the habit of meeting together on some common ground of intellectual or social fitness, and when modes of thought, expression, and fashion prevailed, which, when brought under the notice of the modern reader, as in this book of Dr. Doran's, interest and sometimes astonish those who have not, to some extent, studied this period of our history. The literature of Charles the Second's reign, nay, even far into the time of the Georges, read in connection with the life of Count Grammont, Pepys' and Evelyn's diaries, and the never-to-be-omitted Boswell's Johnson carries us over a period which we do not look back upon with any great pride or pleasure. The national intellect was low, morality, in the higher circles especially, depraved, manners coarse; and altogether it may be said with truth that there never was in the history of England a time when the positively degrading vices of life were so openly practised and so generally countenanced.

Mrs. Montague was not born till 1720, and was not brought up so much with reference to the accomplishments of a fine lady as in the society of learned and thoughtful men—amongst others Dr. Conyers Middleton—and by listening to these, that she might repeat to Dr. Middleton the best points of the conversation after their meetings had terminated, her mind became stored with a kind of knowledge which few women have opportunity to acquire. With all the advantages of fortune as well as personal beauty, it is not to be wondered at that the charming Miss Robinson was much sought after by eligible gentlemen, who, though they might care little for her many accomplishments, were smitten by her beauty, and probably stimulated by the fair monetary prospects of the clever young lady. The correspondence extracted from in these pages begins in 1734, when Miss Robinson was fourteen years of age, and a very sharp and observant mind it indicates on the part of so young a person. As she advanced in

life, a gradually increasing knowledge of the world gave considerable point to her clever remarks on the people she met with, and from this book alone her odd observations on a variety of subjects carelessly thrown out to her various correspondents would make as pleasant a collection as could be culled out of Sam Rogers or Crabb Robinson. Describing society at Bath when in her 20th year, she declares it consisted "all the morning of 'How d'ye does?' and all night of 'What's trumps?'" She mentions an old dowager Duchess who nearly drowned a lot of lady bathers, as being tall, she ordered the bath to be filled till it reached her chin," so that the others had to fly to save themselves. Writing of the officers, or "scarlet beaux," ordered for Flanders, she says "I think they will die of a panic, and save their enemies' powder. Heaven defend the nunneries! I will venture a wager Flanders increases in the christenings more than in the burials of the week." There are a few more jokes of this kind, but as they only passed between young ladies we shall not meddle with them. The following is shrewd, precocial, and pleasant, coming from a girl not yet twenty: "I wish some of our neighbours had married two and three years ago, we should have had a gallant young neighbourhood; but they have lost time, and we have lost lovers by that delay." The following reflection is also sound: writing to her sister, who had joked her on her love of the heroes of antiquity, she remarks: "A living man is better than a dead hero."

When twenty-two she married Mr. Montague, a rich coalowner, and a clever man, though somewhat older than herself. The marriage was very happy, except in the matter of issue. They only had one child, and it died young, but not till Mrs. Montague had proved what a sweet motherly nature she had, and how fit she was to perform for her offspring every requisite duty, notwithstanding her great learning and ability. The affectionate husband and wife did their best to make up for their loss by their unremitting affection for each other, besides which he stuck to his mathematics and his coal, whilst she kept her eyes open, noted what was passing, and sent here and there to her correspondents the sharp shafts of her wit as comment on whatever particularly attracted her notice. Speaking of her own sex, she says, "So strong in women was the desire to please, each would have that happy power confined to her own person." Her description of Queen Charlotte, the bride of George III., given to her by Miss Arnold, is by no means flattering, especially this little touch: "Her mouth fills a great part of her face." This is deliciously feminine. The following is from her sister, Mrs. Scott, and refers to a matter which comes up occasionally, even yet in our political struggles: "We make nobility as fast as people make kings and queens on Twelfth Night, and almost as many. Lady Townshend says she dare not spit out of her window for fear of spitting on a lord." The following electioneering story is not bad: Lady Strathmore, at Newcastle, "sits all day in the window at a public-house, from whence she sometimes lets fall some jewels or trinkets, which voters pick up, and then she gives them money for restoring them."

In 1775, when Mrs. Montague was fifty-five years of age, her husband died, leaving her rich, and completely her own mistress. After this she lived in town and in country at her ease, writing letters as usual, doing good to her friends, and playing the hospitable hostess to men of wit and learning. She had literary breakfasts in Hill-street, to which the most celebrated men of the day resorted. Few lives, on the whole, could have been much pleasanter than that of Mrs. Montague, and when she laid it down in the year 1800, at the great age of 80 years, she certainly did not leave behind her many so fitting to bear the title under which she figures in Dr. Doran's book as "A Lady of the Last Century." We can very heartily recommend this work, both for matter and style.

The Fortnightly Review. Chapman and Hall, Piccadilly.

This "Review" is the most serious, earnest, and important of all our monthlies, and may, therefore, claim for itself an attention commensurate with the seriousness of its aims. The men who write are able, and, as a rule, deal with questions beyond the power of our ordinary run of magazine writers to handle profitably. Whether its readers agree or not with the view put forth on the many questions discussed by the "Fortnightly," they cannot but admire the sturdy spirit and great ability with which they are maintained.

The present number contains several able articles, notably the first by Frederic Harrison on the "Revival of Authority." His attack on politicians for undermining the principle of authority for party purposes is wonderfully well done, but, in granting the propriety of governing by capacity, we do not see so clearly, nor does Mr. Harrison show us satisfactorily, how we are to succeed in finding the right fish, however anxiously and carefully we may throw our line. To ask for the wisest and best is one thing, to get the right answer quite another; and so far as we can see Mr. Harrison has not pointed out a better mode of finding them than that in use, though we are quite willing to admit it is not so successful as we should wish it. The article by John Stuart Mill on "Grote's Aristotle," is, as might be expected, ably and clearly written; in fact, these two articles, were there nothing else worth notice, would make the current number of the "Fortnightly" a valuable contribution to the literature of the country.

The Metropolitan Weekly and Provincial Press. By James Grant. George Routledge and Sons.

This is a work of much elaborateness, but we are disposed to think of very slight value. Mr. Grant has heaped up piles of what he calls "facts," which are, for the most part, haphazard statements, such as any gossipping "picker up of unconsidered trifles" might sweep into his bag. Were such a work, as in this case, has been done so clumsily, and with scarcely a trace of intellectual discrimination, performed in an able and judicious manner, it could not fail to be most interesting and instructive. The growth of the newspaper press in England, illustrated by the lives and labours of those who stimulated it, would be a history explanatory to a great extent of the intellectual, moral, political and industrial growth of the nation. This is not to be done in the way in which Mr. Grant has performed his task. In aiming at everything he has actually done little, and he breaks down utterly in his attempts to develope the spirit that gave form and direction to this great work, through his partiality for describing the mere outside and most vulgar characteristics of newspaper management, and the literary labours connected with it. For such a book, which treats almost exclusively of supposed "facts," if we simply find a mere record of statements, made with the least possible regard to exactitude, it ceases at once to have any claim on the respect or attention of the reader; and unfortunately for Mr. Grant, one of the very first statements he makes is not only blundering and clumsy in the way in which it is put, but utterly wrong in its facts in regard to the papers to which it refers. He tells us that Wm. Gifford was editor of the *Anti-Jacobin*, which is quite true, and that he operated on "Peter Pindar" (Dr. Walcot) with his literary scalping-knife, that in consequence of this the Doctor rushed after him into the shop of the publisher in Piccadilly with the view of cudgelling him, and was bundled out, and rolled into the mud by the bystanders. But the funny side of this matter according to Mr. Grant, was, that it was not William Gifford, but a Mr. John Gifford, who wrote the lampoon, and that it did not appear in the *Anti-Jacobin*, but in the "*Anti-Jacobin Review*—a weekly journal which had been started contemporaneously with the *Anti-Jacobin*." Why Mr. Grant should tell us first that it was William Gifford who did the lampoon on Peter Pindar in the one paper, and then immediately after inform us it was John Gifford who did it in another paper, he, perhaps, knows best. What we complain of, however, is that his "facts" are altogether wrong. The *Anti-Jacobin* was started in November 1797, and died in 1798, and was published weekly; and that William Gifford did write the attack on Dr. Walcot, and that that attack is printed in Gifford's works. Whereas, the *Anti-Jacobin Review* was a monthly magazine, which did not come into existence till July 1798, and was continued for many years, and in its first numbers was illustrated by some of the most characteristic and vigorous political caricatures of Gilray. This is a specimen of Mr. Grant's accuracy; as to his tediousness, those who have time and inclination to wade through the book can easily find it out for themselves. It is but justice, however, to say, that nobody could have put together the mass of unimportant matter this volume contains without being dull, so that the tax imposed on the patience of the reader cannot be considered as entirely the writer's fault.

Boscobel; or, the Royal Oak. By W. Harrison Ainsworth. 3 vols. Tinsley Brothers.

How many of our present race of novelists will be read by the next generation of those who haunt circulating libraries?

This question is not so difficult to answer as at first sight it may appear, though prudent critics would be worse than foolish if by attempting an answer they laid themselves open to the attacks of those to whom they might hint the fate of forgetfulness. Mr. Harrison Ainsworth is not one of our worst writers; old readers cannot easily forget the stirring life of "Rookwood," nor with all its faults, and they are grave and many, can anybody say with justice that "Jack Sheppard" does not possess ability and interest, though of a coarse and startling kind.

We need not refer to the many books, some better some worse, given since these his earliest efforts, to British readers by Mr. Harrison Ainsworth. But we do feel disposed to ask why he should have taken the trouble to write "Boscobel?" What between Mr. Froude and his Irish squabble, and the rival theatres, we are absolutely getting sick of the first and second Charles and all belonging to them. We do not, nor can anybody care a straw for the wretched stage figures of Mr. Ainsworth's "Boscobel" volumes with their meaningless cant exclamations. Our English royalists were some of them chivalric though, as a rule, they knew very well the value of money—whilst our Roundheads, in a very keen, practical manner, found out how to make the best of both worlds; there were, nevertheless, heroes in those days, men who acted nobly and suffered willingly, but in Mr. Ainsworth's romance, this noble and patriotic side of our English life has not been brought out, and when he sprinkles his pages with such phrases as "odds fish," "adzooks," "zounds," "si'death," and with Roundhead slang to match, we care nothing about the thing, and throw the whole aside as more uninteresting than Master Peter's puppets when the show was over.

Memoir of Nathaniel Hawthorne. With Stories. Now first published in this country. By H. A. Page. Henry S. King, and Co., Cornhill.

This book has been denounced in very un-

measured terms by a literary contemporary, who assures us that the whole thing, as regards the matter as well as the mode of its publication, is an injury, and it may be said an insult to the relatives and representatives of Mr. Hawthorne. Of this we know nothing, and cannot, therefore, enter into the merits of the case, but in perusing the contents of the volume we by no means feel disposed to endorse the condemnation to which we have alluded.

The writer is evidently a strong admirer of Hawthorne, and certainly in publishing this sketch of his life could have no intention of injuring his character as a man, or his reputation as a writer. There is really nothing in the volume which any ordinary enquirer might not have found out without much trouble, just so much as is usually known of any man whose fortune, or misfortune, it may be to attract public attention by his writings or acts. What we find fault with in this book is a flippancy of tone, which, whilst it professes to deal with the inner impulses and movements of Hawthorne's rather peculiar idiosyncrasy, really only touches his mental peculiarities in a very superficial manner. Still what is said is pretty well said, and will, no doubt, have the effect of sending many readers to Hawthorne's books with a view of judging for themselves. A great deal is said for a man who gave himself almost entirely to the writing of tales, when readers are assured that he possessed a genius worth studying. The specimen stories given furnish some justification of the praises contained in the life, but to understand Hawthorne, a full study of what he has done is absolutely requisite. Light trifles hurriedly thrown off never represent the serious work of a gifted writer's life.

HONOUR TO INVENTORS.

WE learn with pleasure, says the *Mechanics' Magazine*, that a portion of the New York Central Park has been selected for the location of memorials to the inventors of all nations, and that one of these memorials is to be erected to Elias Howe "the Inventor of the Sewing Machine." The good fortune to bestow equal benefits on mankind is reserved to few inventors, and a large share of the legacy has fallen to our countrymen. While all classes have been benefited, the object appeals especially to the sympathies of the inventive class, of which Mr Howe was an illustrious representative. The estimated cost of the memorial is fifty thousand dollars—ten thousand pounds. The committee of the memorial fund, formed in this country, includes among others, Sir William Fairbairn, Bart., Bennett Woodcroft, F.R.S., Donald Nicholl, Esq., P. Le Neve Forster, M.A., Thomas Webster, Q.C., F.R.S., George Haseltine, LL.D., David Chadwick, M.P., and William Muir, C.E., Dr. Charles W. Siemens, F.R.S., and other eminent inventors have tendered their co-operation. The composition of the committee indicates general interest in the movement, and is an earnest of its success. Truly, the victories of peace are nobler than the victories of war, and the veneration of the heroes of these victories illustrates the spirit of modern civilization.

RAWCLIFFE, BIBBY, AND FLEMING'S IMPROVEMENTS IN SPINNING MULES.

THIS invention consists in fixing on the radial arm used in spinning mules, a lever oscillating on its centre, instead of being simply hinged to such radial arm. One end of this lever carries the ordinary stud or pulley used for tightening the winding-on chain, the other end of the lever is jointed to a connecting rod, the opposite end of which swivels on a travelling stud moved by the common ratchet wheel and catch, and mounted in a frame firmly secured to the floor or the framing of the headstock of the mule. The gradual moving of this stud, starting from a point nearly in a line with the centre of the quadrant at the commencement of the cap where no tightening of the winding-on chain is required, imparts to the oscillating lever on the radial arm a continually increasing motion throughout the working of the cap, the amount of which motion can be so nicely adjusted as to compensate for the gradually diminishing diameter of the spindle as the cap progresses, and without the slightest strain upon the yarn, at the same time the use of springs to raise the lunged lever out of the way of the carriage is dispensed with, as is also the sliding hooked rod for pulling the lunged lever by substituting a connecting rod vibrating on fixed centres by means of which the oscillating lever on the radial arm is raised out of the way of the carriage, thus removing all liability to accident, and imparting a much steadier motion to the tightening stud on pulley.

ASBESTOS STEAM PACKING.

THE marvellous properties and consequent prospective value of Asbestos to mankind have been known to some extent and appreciated for thousands of years, and much money has been expended in endeavours to make it available, but up till within a few years these experiments have for the most part resulted in failure. However, the plan now being carried out by the Patent Asbestos Company at Glasgow, claims to have accomplished the desired effect. The raw material is brought to their manufactory in considerable quantities from different parts of the world. It comes in sacks and bags like chips and blocks of wood, but of a beautiful white colour. Experiments and study have demonstrated to the proprietors the best method of disintegrating and picking apart these chips and blocks and reducing them to a fibrous condition like jute, flax, or cotton. The material, once properly opened up it is, by means of machinery, which is both simple and ingenious, formed into packing of the usual market sizes. These machines are as easily attended as the weaving looms, and each is under the care of a young woman who, after a short time, becomes expert in the business, and is capable of turning out a first-class article. It is completely reeled up in coils as made, and, when of proper size, is securely tied, covered with bagging, and sent to all parts of the world.

Although the business has been in operation little more than a year, it appears that the consumers of Asbestos Packing express themselves in the warmest manner as to its desirable properties and durability. In fact, the first packing in an ocean-going steamer was put in more than sixteen months since, and is still apparently as perfect as ever. The vessel alluded to is the *Anglia* one of the Anchor Line Transatlantic Passenger Steamers. She has made 11 round trips to America and back, having steamed, on the same packing, over 98,000 miles. This, also, is the case with the first locomotive engine in Great Britain. The original packing, put in on 28th July of last year, remained in 11 months and 12 days, when the engine went into the repair shop for overhauling, and the packing was taken out. After that test it was apparently as fresh and useful as when first put in. The engine was an express passenger locomotive on the Caledonian Railway, and ran over 50,000 miles on the same packing. The practical uses to which it is not only possible, but probable, that Asbestos will be put, are almost numberless. Occupying, as it does, the position of a connecting link between the animal, vegetable, and mineral kingdoms, and possessing the properties of all, scarcely too much can be claimed for it in regard to its adaptation to appliances. Asbestos boats, tubs, boxes, wagon bodies, and even railway carriages, which will neither rot, burn, nor splinter, are said to be practicable and possible. In fact, so varied and peculiar are the qualities of Asbestos, and so adaptable is it to the wants of mankind, that it is looked upon by some as the "coming material." Gentlemen connected with the works have, during the last five years, made many curious and interesting experiments with it, and from the experience thus derived, have covered many uses of the materials with patents in Great Britain and other countries. The office of the Patent Asbestos Company, we may add, is at 154, St. Vincent Street, Glasgow.

BEDWELL'S LIFE-SAVING BOAT FITTINGS.

THE object of this invention is to provide boats with seats, fittings, or appliances, so fitted or secured thereto that it shall be requisite that they should accompany such boats when putting to sea or taking the water. These seats, fittings, or appliances, consist of loose or detachable thwarts or other seats, which, from their construction, will serve as life buoys when detached from the boat, as, for instance, when the boat is capsized or swamped. These seats are fitted at their under side with cork, or with air-tight metal, or other cases to give them increased buoyancy, and they are further provided with life lines, or loops of small rope at their edges. When, therefore, the boat is immersed, the seats will be disengaged from the boat, and will float upon the water, and the lines which they carry will permit of their being secured and used as life buoys by the immersed crew. The gratings, foot boards, back boards, hatchway covers, and all other loose fittings of boats may also be fitted similarly to the seats and for the like purpose. Additional floating fittings may also be fitted in any boat, between the thwarts, along the side of the boat, or elsewhere, in cases when it would weaken the boat by having loose thwarts or otherwise. If thought desirable, one end of the life saving fittings may be attached to the boat by a lanyard fitted with a loop and toggle (or button), so that a person when immersed may either remain near the boat or may detach the life buoy seat therefrom. This invention also provides that all or any of these moveable fittings may be, if so desired, fixed temporarily in the boat in such a manner as may be most suitable, in order to give additional buoyancy to the boat instead of floating away independently.

DOCK FOR CIRCULAR IRON-CLADS.

MR CLARK has recently designed an Hydraulic Lift Dock, capable of raising circular iron-clads, of about 150 ft. in diameter, larger though similar to those which the Russian Government are now building for coast defence. This description of dock probably furnishes the most economical and expeditious means of docking such vessels, their great breadth rendering the construction of an ordinary Graving Dock very undesirable, as, in addition to all the usual difficulties to be overcome, lock gates or caissons of most unwieldy size would have to be provided. The dock is intended for a vessel drawing about 15 ft. of water, and weighing about 8,500 tons, the total weight to be lifted, including vessel, pontoon, girders, rams, &c., would, in this case, be about 11,000 tons. The presses—of which there are three in each column—are arranged in three groups, the pipes in connection with each group being shown by the boundary lines in the figure. It is estimated that this dock can be completed, ready for use, within eighteen months, at a cost of £214,000, including all its machinery and one pontoon, but not including any masonry.—*Naval Science* for January.

THE SCIENTIFIC EXPEDITION IN H.M.S. *CHALLENGER*.

PROF. WYVILLE THOMSON, in accordance with the suggestions of the Royal Society, intends during his voyage round the globe, which is expected to last four years, to carry out an extended system of ocean soundings and deep dredgings, so as to obtain a more perfect knowledge of the physical and biological conditions of our great oceans. A chemical examination of the oceanic waters is to be continuously made, the specific gravities, and temperatures at varying depths, to be systematically ascertained, the velocity and drifts of the Gulf and other great currents, at different depths, are to be measured, a series of magnetic observations carried out with the most approved instruments. In addition to these matters, the zoology and botany of those countries least known to us are to be carefully studied. The ship is fitted up with an analyzing room, a photographic-room, and every appliance necessary for the complete investigation of all the great physical phenomena of the Earth's surface. Dredging operations will be commenced in the Bay of Biscay, and continued through the whole length of the Atlantic Ocean, they will then be extended over the wide space of the Pacific Ocean, from Kamtschatka to the Antarctic Circle.

THE BESSEMER CHANNEL STEAMER.

THE following may be taken as the views of Mr. Bessemer and his friends, with regard to the anti-sea sickness vessel he is now building, as it appears in the last number of *Naval Science*, of which Mr E. J. Reed (under whose superintendence the vessel is being built) is the able Editor.

"In ocean steamers great lateral movements (and also vertical ones) are produced in a ship when she is among large waves, except when she is cutting square across them, on account of her partaking of some of the motion of the wave particles, and being moved to and fro, and up and down, upon the slopes of the waves; but this cause will never operate upon this ship, because she will never, between Dover and Calais, fall in with a regular series of waves sufficiently large to produce it. She may be rolled a little from side to side by some Channel waves, but her size is too great as compared with them to make it possible for her to be swayed laterally from side to side as though she formed part of single waves, especially considering the great speed at which she will travel. The only appreciable cause of this lateral motion will, therefore, be that due to the movement of the axis of the saloon when the ship is rolling, and as we have already stated, this is placed at such a height in the ship as will reduce lateral movement to the least possible amount. We now come to the vertical motion. Objectors say that this is the most fatal of all causes of sea-sickness and Admiral Elliot gives a very graphic description of his experience, when lying in a cot, of the effects of the lateral and vertical motions. There is no analogy, however, between the two cases. He deals with the case of a cot slung in an ordinary manner, at a usual place, in a ship at sea, where she meets with waves that are very large in proportion to such ships as he has served in. Therefore his ship was liable to great bodily rising and falling, and this was aggravated by the vertical components of the rolling and pitching movements. In the case of the Bessemer vessel, on her intended service, we have a large vessel floating in comparatively small waves, with all the motions, thus already small, made still smaller by special features in the designs, and (so far as the saloon is concerned) with the remaining portion of the rolling and pitching motions practically annihilated, or very nearly so. What resemblance is there between the two cases? Some bodily rising and falling there will no doubt be, but it will be comparatively small, especially when the ship is at full speed. But even if there were grounds for expecting very much larger vertical motion, that would in our judgment, enhance rather than diminish the desirability of abolishing as far as possible the remaining motions, and furnish no reason whatever for retaining much avoidable misery because some unavoidable discomfort may still remain. The substitution of steamers of this type for the present ones will be a great boon to numerous travellers, even according to the worst estimate that has been put upon their merits. If the saloon could not be kept level, and if lateral and vertical motions could not be prevented from being felt, or if there should be a slight falling off in speed — none of which events are likely to happen — still the greatly increased accommodation provided, the diminished effect the waves will have upon these ships to produce the motions complained of, and the superior speed they will possess to the present ones, upon the worst supposition that can be made, constitute claims that will ensure them the approbation of all who have ever suffered the misery and degradation of rough passages across the Channel in the existing steamers."

HORTICULTURE OF THE PAST YEAR.

THE year 1872 was not particularly distinguished in the annals of horticulture, though it must be owned in its behalf that its memorials present few subjects for regret, if we set aside the one subject, over which man has no control, the weather. On that doleful subject enough has been said, and we would gladly forget all about it, but cannot, because it exercised a most potent influence on the horticulture of the year, and marred not a few well-planned enterprises. However, to show the weather that we are not vindictive, we will bear in mind that every one of the more important exhibitions was well sustained, and, as for the rest, let bygones be bygones. A healthier year has not been known in modern times, a few out of many of the products of the garden have been better than the average, and in districts were wells and springs had been shrinking for several years past there is now plenty of water, and the subterranean stores will last a long time. The activity of trade, the abundance of money, and the large and regular supplies from abroad of staple articles of food and materials of manufacture, have tended in a remarkable degree to mitigate the effects of rising prices, the disturbances in the labour market, and various deficiencies in the harvest of the year. We have turned the new leaf, the holidays are over, and the prospect is in no way clouded by portents; it is, in fact, at the present moment brighter than the retrospect, and we seem to be reaching out our hands to better things than those the past year made us familiar with. – *The Gardener's Magazine.*

THE FALLING STARS OF NOVEMBER, 1872.

I WAS so fortunate as to witness, at Boston, this marvellous display of meteors, now proved beyond all doubt, both by previous calculation and subsequent observation of astronomers, to have been due to Biela's comet passing very near the earth's orbit, and almost her place in the orbit at the above date; the comet's substance being, as Professor Herschel said, "distributed into the form of a meteoric stream." (*Times*, November 29.) Within a few minutes I counted hundreds of "falling stars," and they appeared to "fall" from, and to, every point of the compass. They were seen all over Europe at the same time, and their distance from the earth, according to the best observers, not being very great at the moment of their visibility, suggests the question whether the opinion once most prevalent as to their nature, cause of luminosity, or the extent of the earth's atmosphere be not erroneous. Are these cometary fragments in any sense solid bodies, which, although they have their origin far beyond the earth's atmosphere, are only visible through incandescence by friction with it? And if so, may not aerolites, or falling stones—of which the ancients have recorded examples—and fireballs also have a cometary origin? The periodicity of all has been found remarkably identical. May not some of the shooting stars of November 27 have mingled with our atmosphere, and had something to do with the abnormal atmospheric phenomena of the last three months? The astronomers who recorded the appearances of the meteoric shower also noted variations of the barometer before, during, and after that event; and during the recent gale bright meteors were observed at Dover. May not comets, in fact, have some influence on our atmospheric changes?

HAWKE'S AND FREEMAN'S IMPROVED BILLIARD TABLES.

THE object of these improvements is to construct tables so that they may be rendered more convenient than heretofore for the purposes of billiards, for dining, or for other purposes, and consists in the construction and use of a rising and falling horizontally telescopic and expanding or moveable frame, in addition to a fixed frame, together with moveable and adjustable covers or flaps, so that when it is necessary to convert the billiard table to a dining table, the top or bed thereof can, together with its rising and falling frame, be lowered, and the top or bed covered with suitable lids or covering pieces the size of the billiard table, and when desired, suitable flaps, trays, or additional length of covering pieces or lid, can be pushed out or drawn in by means of the horizontal, telescopic, or expanding part of the frame, or when required to be converted from a dining table to a billiard table, the top or bed can be elevated, the lid pieces removed, and the projecting lid drawn in or shortened if desired. These improvements may be carried out in practice by forming the legs of the table so as to receive and allow of the working of a rising and falling spring attached to the rising and falling framing supporting the top or bed of the billiard table, such legs to be connected or kept firmly in place and together by suitable ties or under-framing which is not moveable, and on which the rising and falling frame rests when at its lowest position. The billiard table with its cushions is furnished with a suitable lid or cover which may be in one or more pieces, and is put on when it is desired to use the table for other purposes. Attached to the frame are sliding shelves, trays, or flaps, which by means of a screw can be pushed out or drawn back, and so lengthen and shorten the table, lid, or cover, when desired. When the table is elevated, and used as a billiard table, suitable moveable wedges or other convenient means can be used to steady the table.

THE GARDENER'S MAGAZINE.—On the last Saturday evening in December a dinner was given at the Albion, Aldersgate, to celebrate the 1,000th Number of the "Gardener's Magazine," which, it appears, is the oldest of existing horticultural papers. Mr. W. H. Collingridge, of the *City Press*, presided, supported by Mr. Shirley Hibberd, the editor of the magazine, and a number of eminent landscape gardeners, botanists, land stewards, artists and others, who, by pen and pencil, have contributed to the publication.

The Scientific and Literary Review

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Editor's Office: 21, Cockspur Street, Charing Cross, S.W.

Monthly Notices.

Tribunals of Commerce, the Lord Mayor and Mr. J. R. Taylor—A Fame-seeking Inventor—The "Antiquary" and "Naval Science" Reviews Postponed—Blake's Catechism of Zoology—Dr. Yeats' Books on Commerce—Hughes' Physical Geography—"Cosmos"—"Revue de Chimie"—School Board Tyranny.

LAST month we alluded to the fact that the Common Council of the City of London, which professes to represent all the members of that Corporation, without any reference to a large and influential portion of them—the liverymen of the guilds—has thought fit to enter in pigmy giant fashion on the great work of establishing the first Tribunal of Commerce in this country, and we appealed to the present Lord Mayor (Sir S. Waterlow) to use his influence for preventing the progress of the objectionable measure proposed by that body. We also questioned our old friend Mr. J. R. Taylor, who has been very active in promoting the establishment of such tribunals, as to what he was doing. His lordship has vouchsafed no sign, but Mr. J. R. Taylor gives us his answer in a pamphlet, dedicated to one of the guilds, which shows that he is still working with the view to obtain the adoption of a satisfactory plan for the establishment of such tribunals.

In a recent number of the *Athenæum* a person signing himself "Inventor," in a lengthy advertisement, proposes to submit to the British Association for the Advancement of Science "certain suggestions calculated [so he says], if properly carried into effect, to prevent effectually explosions from fire-damp in coal mines." Upon the conditions that within a reasonable time his communications shall be published at the expense of the Association, and "that in case any of the processes suggested and so published shall be developed and brought into general use within the period of ten years from the date of their publication, or shall form the basis, or a component part, of any developed process which shall be brought into general use during that time, Her Majesty's Government shall, upon his application at any time within that period, undertake to recommend Parliament to grant him such payment from the public purse as the Association shall declare him entitled to; and that the members of the Association shall pledge themselves in good faith in their individual, as well as their collective capacity, to use their influence to see him equitably and adequately remunerated." He promises to disclose his name and address. We prophecy that the Association will not (as far as pledging its members individually is concerned, we do not see how it can) accept "Inventor's" offer. We recommend him to adopt the usual course—take out his patent and push his invention into public notice, like every other ingenious man. However, this advertisement of "Inventor" shows the bad character of our unreformed Patent Laws, for if they were what they should be, such a public announcement would surely never have appeared.

We are glad to find that the *Antiquary*, a journal designed as a medium of intercommunication for men of letters, the archæologist, and the reading public, so well sustains its reputation. In another column we give an interesting quotation from its columns on the Falling Stars of November, 1872.

The last number of *Naval Science* fully sustains the high character it was expected to possess. It contains able articles on Naval Autumn Manœuvres, Strains of Ships at Sea, International Tonnage, Principal Armour Plate Experiments, 1872, The Bessemer Channel Steamer, from which we quote in another column, The Hydraulic-lift Dock at Bombay, Deep Sea Waves (by C. W. Merrifield, F.R.S.), and other important articles.

We have for the present to content ourselves with favourably commending to the notice of our readers "The Catechism of Zoology," by Rev. J. F. Blake, M.A., F.G.S. (Longmans), and two works by Dr. John Yeats (Virtue & Co.), one entitled "A Manual of Recent and Existing Commerce," the other "Growth and Vicissitudes of Commerce;" likewise a little volume of Gleig's School Series (Longmans) on "Physical Geography," by William Hughes.

The French serials, "Cosmos," by the Abbe Mognio, and the "Revue Hebdomadaire de Chimie," by Mons. Ch. Mene, are this month well worthy of attention.

The London School Board, instead of directing all its attention to the case of our juvenile human waifs and strays, and promoting, if possible, advanced *practical* education (which means nothing more nor less than technical science instruction) as the ultimatum of popular education, are, it appears, about to ask for powers to interfere with private schools. A nice land of freedom, this little isle will become when we must not only submit to the *sic volo sic jubeo* of chief justices, magistrates, including the great unpaid, and even of Policeman X, but must also be dictated to by School Boards with regard to the educational curriculum of our children.

The Inventors' Institute.

At the members' meeting held on Thursday, December 5th, 1872, the chair was taken by J. Faulding, Esq., Member of the Council of the Institute, who announced that the paper for consideration that evening was on Trade Guilds as promoters of Invention and Technical Education, by F. W. Campin, barrister-at-law, Member of the Council of the Inventors' Institute.

Mr. Campin then proceeded with the reading of his paper, the substance of which is embodied in our article on "Industrial Organizations."

After this paper had been read, Mr. Faulding said that as he considered they had met together more for the purpose of a friendly interchange of ideas on an important subject than to listen to a lecture, and enter upon a formal debate, he would make a few remarks which they might either treat as deserving of debate, or pass over as merely conversational utterances. Mr. Campin had said a great deal about the necessity of utilizing the action of these guilds for the promotion of Technical Education and the advancement of invention, but he had not given the meeting his views as to the system to be adopted in regard to carrying out the kind of education referred to. One very important matter, it appeared to him, was the teaching workmen their trade in a thorough-going way: making them begin at the very beginning, and ascending from the simple and elementary parts of his art to the more complex operations of it. At the present day in nearly all the important trades, machinery or tools, usually termed self-acting, were largely used, the use of which reduced the artizan from the position of a craftsman to that of a labourer, though perhaps an intelligent one, and left him in ignorance of the elementary points of construction applicable to his art. Therefore he considered that in the workshop of any technical college or academy no steam power should be used, so that all workmen students should learn to work without such power. Another evil system as tending to prevent a workman from becoming the master of his art was the practice of putting youths to learn only one part of their trade. Another point of the greatest importance was the necessity there was for teaching drawing and practical geometry to workmen; for want of a knowledge of these subjects working men were often rendered incapable of carrying out new designs or inventions. He was clearly of opinion that when our workmen became properly technically educated, they would be able to work with inventors so as to carry out their plans with success.

Mr. Carttar said that he thought they were much indebted to Mr. Campin for bringing this important subject before the Institute, and he hoped he would persevere in his efforts to make trade guilds useful for the present and for the future; and he was quite sure that every member of the Inventors' Institute would be ready to join with him in tendering to Mr. Campin a cordial vote of thanks; and he would like to couple with the vote of thanks to that gentleman a vote of thanks to the chairman of the evening (Mr. Faulding), whose observations were of great practical value. He therefore moved that the thanks of this meeting are hereby accorded to Mr. Campin for his paper, and to Mr. Faulding as chairman of the meeting. This having been duly seconded, was carried by acclamation.

Mr. Carttar reminded those present that the business for the next meeting was the Patent Laws, which were just now placed in a critical position, as the report of the House of Commons Committee had recommended various changes which if adopted might place inventors in a very false position. Mr. Faulding and Mr. Campin having briefly expressed the gratification they felt at receiving this vote of thanks, the meeting terminated.

At the meeting on December 19th, an announcement by the Secretary of the Institute (Mr. R. M. Latham) was made that her Majesty's Law Officers were understood to be considering the course to be taken with reference to the report of the House of Commons Committee on the Patent Laws, and that it was expected they would take some action in the matter in a short time. It was therefore decided to adjourn the consideration of the present position of the Patent Law question until after Christmas.

GENERAL MEETING ON THE PATENT LAWS.

A general meeting of the members was held at the Institute's Rooms, 4, St. Martin's Place, Trafalgar Square, on Thursday, January 23rd, 1873, to consider and determine what steps should be taken with reference to the report issued by the Select Committee appointed by the House of Commons to enquire into the laws relating to Patents for Inventions. In the unavoidable absence of Sir Antonio Brady, the chair was taken by Mr. Hume Williams, Barrister-at-Law, member of the Council.

The chairman, in opening the proceedings, referred to the past labours of the Institute on behalf of the inventor's cause, and pointed out that the report of the House of Commons Committee was of a very discursive character, containing only a few points worthy of commendation, and that these were evidently a mere *rechauffé* of the suggestions made by the Institute (Cheers.) Many, however, of the recommendations of the Committee appeared to have originated with themselves, and were fraught with very serious danger to inventors. (Hear.) He called upon Mr. R. Marsden Latham to read the Report of the House of Commons Committee, which was as follows:—

Report of the Select Committee appointed by the House of Commons "to inquire into the Law and Practice and the effect of Grants of Letters Patent for inventions. The Select Committee have considered the matters to them referred, and have agreed to the following Report:—

Your Committee have continued the investigation commenced last Session into the law, practice, and effect of Grants of Letters Patent, and after a careful consideration of the evidence on the respective branches of the inquiry given by eminent lawyers, patent agents, inventors, and manufacturers of this and other countries have arrived at the conclusions contained in the following Resolutions:—

1. That the privilege conferred by letters patent promotes the progress of manufactures, by causing many important inventions to be introduced and developed more rapidly than would otherwise be the case.

2. That the same privilege leads to the introduction and publication of numerous improvements, each of a minor character, but the sum of which contributes greatly to the progress of industry.

3. That in the absence of the protection of letters patent, the competition of manufacturers amongst themselves would doubtless lead to the introduction of improved processes and machinery, but that it would probably be less rapid than under the stimulus of a patent law.

4. That it does not appear that the granting of pecuniary rewards could be substituted, with advantage to the public interest, for the temporary privilege conferred by letters patent.

5. That the existing patent laws of this country and its administration are in many respects defective, and require considerable improvements in the interests of the public, of manufacturers, and of inventors.

6. That protection for a limited period, and dating back to the time at which it is applied for, should only be granted for an invention on its nature, and particular points of novelty, being clearly described in a provisional specification, and upon the report of a competent authority that such invention, so far as can be ascertained by such authority, is new, and is a manufacture within the meaning of the law.

7. That letters patent ought not to be granted for any invention so protected until the provisional specification has been open to inspection, nor until a complete specification has been deposited fully describing the means of carrying it into effect, and such complete specification has been found by the same authority to accord in all essential particulars with the description of the invention in the provisional specification.

8. That all letters patent should be subject to the condition that the manufacture shall be carried on within the United Kingdom, so as fully to supply the demand for the same on reasonable terms to the public, and with due regard to the existing interests.

9. That letters patent shall not be valid for an invention which has been in use in a foreign country, unless a patent for the same shall have been granted in such country, and unless such letters patent shall have been granted in this country to the original inventor, his assignee or authorised agent.

10. That the duties payable on patents should be so adjusted as to encourage inventors to the utmost to make known their inventions, and that their primary application should be to the purposes of a complete and well organized record of industrial progress, and to an improved establishment for the conduct of patent business.

11. That no person concerned in the administration of the patent law should have a pecuniary interest in the number of patents applied for, granted, or refused.

12. That, inasmuch as the property created by the patent law, and the questions arising under it, are peculiar, the tribunal for deciding contentious matters in reference thereto should, both as to its constitution and procedure, be adapted to those peculiarities.

13. That the present condition of the Patent Commission is open to serious complaints.

14. That the Patent Law Amendment Act of 1852 provided that the Commission should consist of certain *ex officio* Commissioners, viz., the Lord Chancellor, the Master of the Rolls, and the Law Officers of the Crown for England, Scotland, and Ireland, together with other persons to be appointed by the Crown, but no such other persons have ever been appointed.

15. That the Lord Chancellor, the Master of the Rolls, and the two English Law Officers are now the only Commissioners, and by reason of their other engagements it is very difficult to get a meeting of the Commissioners, and practically an officer in the Patent Office does the duty of the Commission.

16. That the law and its administration are defective:

(a) They admit of protection, and, subsequently, of a patent being granted for an invention which is not properly the subject of letters patent, not being a manufacture, or, being a manufacture, is not new; and of patents being granted for the same invention to several contemporaneous applicants.

(b) They offer no guarantee against patents being used solely or chiefly for the purpose of obstruction.

(c) The facilities afforded to an intending patentee for ascertaining whether his invention is new are insufficient.

(d) The time, trouble, and expense involved in proceedings affecting the rights of patentees and of the public are excessive.

17. That the following alterations of the law, and of its administration, are desirable.

(a) That protection be not granted to any invention except on the report of a competent person or persons that the conditions of Resolutions 6, as to such protection, are fulfilled.

(b) That no warrant for sealing letters patent be issued until the conditions of Resolution 7 are fulfilled.

(c) That in the case of several concurrent applications for a patent for the same invention, the patent be granted to the

first applicant, unless it be shown to the satisfaction of the proper authority that he is not the first inventor.

(*d*) That all trials of patent causes should be before a judge, with the assistance of skilled advisers (who may be Commissioners of Patents), and, as a rule, without a jury; but with power for the court to order a jury for the ascertainment of facts in exceptional cases requiring the same.

(*e*) That the Commissioners be reinforced by the appointment of competent persons of legal, scientific, and technical experience, whose time is not occupied with other engagements to such an extent as to prevent their giving full attention to such administration.

(*f*) That the Commissioners should make rules, relegating to some of their body, together with competent assistants, amongst other duties, that of ascertaining as to every invention for which a patent is sought to obtained, whether it is properly the subject-matter of a patent; whether its nature, and the particular points of novelty, have been clearly described in a provisional specification, and whether, so far as can be ascertained by them, it is a new invention; and, as to the complete specification, whether it fully describes the means of carrying the invention into effect, and accords in all essential particulars with the description thereof in the provisional specification.

(*g*) That all letters patent should contain the following conditions not hitherto usually inserted therein, viz.:—That the manufacture be carried into effective operation within a reasonable time, within the United Kingdom by the patentee or his licensees so as to supply the demand therefore on reasonable terms; and that licenses be granted by him to competent persons on fair conditions, such conditions, as well as the fact of competency, to be determined in the event of disagreement by the Commissioners, due regard being had in such determination to the exigencies of foreign competition.

(*h*) That besides the assistance afforded to intending patentees by the examination of their specifications, and by the Reference Library of the Patent Office, more satisfactory indices and abridgments of specifications be provided, and more particularly that the practice of accepting, without control or revision, the abridgments prepared by the patentees themselves be abandoned.

(*i*) That the court or judges having discretion in patent litigation should avail themselves of the assistance of the Commissioners for the better definition and limitation of the matters in dispute in respect of particulars of breaches and of objections respectively.

(*j*) That in all future appointments of officers concerned in the administration of the patent law, remuneration by fees should (as it has been in the recent appointment of Her Majesty's Solicitor General be discontinued.

18. That suitable provision should be made by Parliament for the remuneration of the Commissioners who do not act *ex officio*.

19. That this Committee are of opinion that there should be an assimilation in the law and practice in regard to inventions amongst the various civilised countries of the world, and that Her Majesty's Government be requested to inquire of Foreign and Colonial Governments how far they are ready to concur in international arrangements in relation thereto.

Mr. F. W. Campin, Barrister-at-Law, and member of the Council, observed that he entirely concurred with the remarks of the Chairman, and he thought he should have no difficulty in convincing the meeting that although the report just read did contain some valuable suggestions, such as that marked (*c*) in the report, which would prevent a *bona fide* applicant for a patent being defeated by a later applicant racing before him to the Great Seal, a trick which is now allowed by our Lord Chancellors as legal; and those marked *d*, *e*, *f*, *h*, *i*, *j*, would be found to contain some good points, though so warped and distorted that if adopted in the form proposed by the Committee, they would, he thought, only work evil. (Hear, hear.) But the main objection was as to that one marked (*g*), the effect of which would be to oblige Inventors to make only such charges for the use of their inventions as the Commissioners might think fit. This, he thought, would be destructive to the right of inventors as to the property in their own inventions. (Hear, hear.) And he hoped that the Institute would come forford as one man and give a most strenuous opposition to so iniquitous a proceeding.

Captain J. H. Selwyn, R.N., Vice-President of the Institute, criticised with great force and humour the several propositions of the report, and he concluded by remarking that if the amendments suggested by the House of Commons were all they were willing to accord to inventors, the best thing that could be done would be to ask to be let alone. (Loud cheers.)

After some pertinent observations, expressive of strong disapproval of the Committee's recommendation, by Mr. F. H. Varley, Mr. A. J. Murray, Mr. Atterbury, of West Bromwich, Mr. J. R. Cressey, Mr. Carttar and others,

Mr. Latham observed that what was chiefly needed by inventors, and insisted on by the Institute, were, first, a great reduction in the cost of obtaining patents—(hear, hear)—as it was neither just or expedient that inventors should have imposed upon them a heavy tax for giving new inventions and articles of manufacture to the world. (Applause.) Secondly. That there should be a greater simplification in the cumbrous and unsatisfactory procedure now adopted for the obtaining of patents (Hear) Thirdly. That the duration of patent rights should be extended, and that invention right should be, at least, of equal duration with copyright Fourthly. That the infamous procedure in our Law Courts with regard to the endless expense and worry entailed upon inventors in vindicating their patent rights, should be wholly abolished—(cheers) —and a rational, inexpensive procedure should be substituted in its stead. (Applause) He maintained that the report just read so far from according any of these desiderata would—(1) Involve inventors in largely increased expense in obtaining their patents; (2) would augment, to an intolerable degree, the circumlocution and red tapeism of the present procedure in obtaining patents; (3) It entirely ignored the right of the inventor to such an increased duration of invention right as would confer upon inventors reasonable prospects of remunerating themselves for their labour, expenditure, and skill in developing, and perfecting new articles of manufacture—(hear), (4) and that no relief whatever was conceded by it in regard to the shortcomings and delays now attending patent law suits. (Loud cheers.)

It was ultimately decided that a subcommittee, to consider and report *seriatim* to the council, be appointed, consisting of Messrs. Captain J. H. Selwyn, H. Williams, F. W. Campin, F. H. Varley, A. Murray, and the officers of the Institute, and that a general meeting of the whole body of the Institute be convened to consider such report, and determine the steps to be taken in vindication of the inventor's rights.

We understand that Miss Hill, a daughter of the late Sir George Hill, Bart., is about to issue, in a cheap form, some very clever and spirited sketches and verses entitled "Passages in the Life of Blue Beard," and that they will be published by Dean and Son, of Ludgate Hill.

Proceedings of Societies.

THE INSTITUTION OF CIVIL ENGINEERS.

This society has now been in existence fifty-five years, having been established on the 9th of January, 1818. It was incorporated by Royal Charter on the 3rd of June, 1828, and the numbers of the several classes constituting the corporation on the 1st inst., were 16 honorary members, 759 members, and 1,151 associates, with a class of students attached of 267, together 2,193. Ten years ago there were on the books 20 honorary members, 413 members, 574 associates, and 10 graduates, together 1,017 of all grades. The class of graduates was abolished in the year 1867, when the class of students was instituted.

At the meeting of this Society on Tuesday the 14th of January, Mr. Hawksley, President, in the chair. Twelve candidates were balloted for and declared to be duly elected, including two members, viz., Mr. Arrott Browning, of the Madras Irrigation and Canal Company, and Baron Max-Maria von Weber, Imperial Royal Councillor in the Austrian Board of Trade. Ten gentlemen were elected Associates, viz., Mr. William Frederick Alphonse Archibald, B.A., Stud. Inst. C.E., Surveyor, Metropolitan Board of Works; Mr. Nicholas Procter Burgh, Waterloo-bridge-road; Mr. Henry Carmichael Christopher, Surveying Officer, P.W.D., Ceylon; Mr. Edmund Henry Harris, Engineer and Manager of the Water and Gas Works of the Wallasey Local Board; Mr. Benjamin Kitt, Gas Examiner to the Corporation of Bristol; Mr. John Mackay, Shrewsbury; Mr. Joseph Prime Maxwell, Stud. Inst. C.E., Contractors' Staff, Devon and Cornwall Railway; Mr. William Henry Scott, Local Fund Engineer, Dharwar, Bombay, Mr. John Isaac Thornycroft, Chiswick, and Mr. Richard Tiplady, Principal Resident Engineer, Bahia Railway, Brazil.

The Paper read was on the "Practice and Results of Irrigation in Northern India," by Colonel W. H. Greathed, C.B., R.E., Chief Engineer of Irrigation to the Government of the North Western Provinces. This Paper will be found in another column.

It was announced that the Council, acting under the provisions of the bye-laws, had recently admitted Messrs. James Samuel Brown, William Coulthurst Gibbons, Arthur Trethowen Goodfellow, Alfred Joyce, Horace Challoner Knox, Theophilus Michell, Alexander Miller, jun., George Moyle, George Augustus Grant Shawe, and Zacchaeus Walker, Students of the Institution.

VICTORIA (PHILOSOPHICAL) INSTITUTE.

A very full meeting of the members of this Institute recently took place at its rooms, 8, Adelphi-terrace, Mr. C. Brooke, F.R.S., in the chair. The election of several new members having been announced, Dr. C. R. Bree read his paper on "Darwinism and its Effects upon Religious Thought." Having defined these, he proceeded to show that the theories held by Mr. Darwin and his school, if argued out to their logical conclusions, were actually subversive of belief in divine revelation. Many quotations from various authors were given. We quote three; one from Mr. Herbert Spencer:—

"Every kind of being is conceived as a product of modifications wrought by insensible gradations on a pre-existing kind of being; and this holds as fully of the supposed 'commencement of organic life' as of all subsequent developments of organic life. It is no more needful to suppose an 'absolute commencement of organic life,' or a 'first organism,' than it is needful to suppose an absolute commencement of social life and a first social organism."

And the other from Mr. Darwin in his "Descent of Man" (vol. i. pp. 66-7), about the probability of religion having its origin in dreams. "It is probable, as Mr. Tylor has clearly shown, that dreams may have first given rise to the notion of spirits," and "the belief in spiritual agencies would easily pass into the belief in the existence of one or more gods." And so, according to Mr. Darwin's views, was religion "evolved."

And a third from *Nature*, July 11, 1872. In a recent review of a work called the "Martyrdom of Man," we are told that the author, after working out the evolution of animal and human faculties, goes on to "urge all enlightened men to take part in the great work of demolishing one of those institutions which, once the highest attainable, has now become injurious. Christianity must be destroyed." And he concludes his work in these words: 'But a season of mental anguish is at hand, and through this we must pass in order that our prosperity may rise. The soul must be sacrificed, the hope in immortality must die. A sweet and charming illusion must be taken from the human race, as youth and beauty vanish never to return."

Dr. Bree then called attention to the fact that according to the theory of evolution, "a primitive speck of matter came into being, evolved from non-living matter by the agency of physical forces." Professor Huxley had called this the basis of life, that such specks of living matter have given origin to all plants or animals, but Dr Bree held that such a theory, even if true, did not go back far enough to explain the theory of all creation. After referring to the inconclusiveness of some, and the want of evidence for many other theories advanced by the Darwinian school, he urged that it was not the part of true science to attack religion, as was so often done, but rather patiently to practically pursue its course.

The discussion was taken part in by Dr. Irons (who held that truth could never contradict itself, and hence there could never be any real antagonism between science and revelation; Admiral Halsted (who urged the importance of thorough inquiry); Dr. Fraser; Mr. I. T. Pritchard; Captain F. Petrie (who, referring to a remark made by a previous speaker, stated that the results of the experiments and researches of Professor Huxley and other leading scientific men, had as yet proved that though it was comparatively easy to classify and arrange the addition of every animal, yet man held his place superior to all, and refused to "fit in" anywhere, and it was acknowledged that there was an immeasurable gulf between him, with all his attributes, and the rest of animal creation).

Dr. Bree having replied, the meeting was adjourned.

We may add that a letter was read from the Right Hon. W. E. Gladstone, stating that he had read the proof-copy of Dr. Bree's paper, and expressing the interest with which he had done so. From a printed report it appears that one hundred and fifteen additional members joined the Institute last year.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

A MEETING was held on Tuesday, January 7, at 9, Conduit-street, W., Dr. Birch, F.R.S., president, in the chair. The following gentlemen were duly elected members of the society:—Rev. John Finlayson, M.A.; Right Hon. William Ewart Gladstone, M.P., D.C.L., F.S.S.; D. Clewin Griffith, Esq., F.R.G.S.; John Henry Gurney, Esq.; Rev. W. Houghton; B. G. Jenkins, Esq.; Charles T. Newton, Esq., M.A., F.R.S.L.; George Warington, Esq., B.A., F.C.S.; Rev. John Wells, M.A.

Two papers were then read:—

1. On some recent Discoveries in South-Western Arabia. By Captain W. F. Prideaux, F.R.G.S.—This paper consisted of a carefully digested summary of the history and geography of the country of the Himyarites, from traditional Arabic literature, and the safer testimony of the coins and bronze inscriptions collected and translated by MM. De Longperier and Halevy.

The first portion of the paper was devoted to an examination of the capital and descent of the Shabean kings, whose seat of empire the learned writer maintained was not, as is generally supposed, at San'a, but at a place described by the Poet Algama Dhu Yazna as Dhu Raidan, the ΡΑΕΙΔΑΝ of Greek writers. Captain Prideaux also further endeavoured to identify some of the chief monarchs mentioned on the Himyaritic tablets with those referred to in Dean Vincent's "Periplus of the Erythræan Sea," by the help of the numismatic discoveries of the Duc de Luynes and the Compte de Vogué.

In the second portion of the essay the numerical system of the Himyarites was examined, and several inscriptions translated, and the paper concluded by a reference to the cleverly forged bronze tablets, now in the British Museum, which have only recently been detected by philological criticism.

2. On the Tomb of Joseph at Shechem. By Professor Donaldson, Ph. D., K.L., F.R.S., B.A. This was a description of the present state of that most interesting and well-authenticated antiquity, derived from a very recent visit to the Holy Land. The learned Professor believed that the actual sepulchre was in a vault under the present Moslem structure, which is considerably out of repair, and is in no small degree injured by the subsequent erection of two Mahommetan tombs, which are also falling into decay. In the further side of the building are two memorial tablets, and a third in English, recording the burial of Joseph, is about to be affixed by the order of the late British Consul at Damascus.

ZOOLOGICAL SOCIETY OF LONDON.

JANUARY 7TH, 1873, Robert Hudson, Esq., F.R.S., V.P., in the chair. The secretary read a report on the additions that had been made to the society's menagerie during the month of December, 1872, amongst which were particularly noticed specimens of the American darter (*Plotus anhinga*), and a black-necked stilt (*Himantopus nigricollis*)—both new to the collection. Mr. P. L. Sclater exhibited some skins of birds, sent to him by Dr. George Bennett, F.Z.S., of Sydney, N. S. W., which had been collected by Capt. Fergusson, of the steamer *Captain Cook*, during a trading voyage to New Britain, New Ireland, and the neighbouring islands. A communication was read from Dr. J. S. Bowerbank, F.R.S., containing the fourth part of his contributions to a General History of the Spongiadæ. A second communication from Dr. Bowerbank contained a report on a collection of sponges formed in Ceylon by Mr. E. W. H. Holdsworth, F.Z.S. Mr. E. W. H. Holdsworth read a note on a rare sponge (*Xenospongia patelliformis*) found on the coast of Ceylon. Mr. A. H. Garrod read a paper on a peculiarity in the termination of the anterior margin of the nasal bones of certain birds, according to which the schizognathæ of Prof. Huxley might be divided into two groups, to be called schizorhinæ and holorhinæ. A communication was read from Dr. J. E. Gray, F.R.S., on the species of mud tortoises (*Trionyx*), and on the skulls of the different kinds. A second communication from Dr. Gray contained notes on the Guemul of Patagonia (*Huemula leucotis*), founded on the skins of a male and female guemul obtained in a valley of the Cordilleras, in lat 46 deg. S. L. by Don Henrique M. Simpson. A communication was read from the Rev. John T. Gulick and Mr. Edgar A. Smith containing descriptions of new species of *Achatinellinæ* from the Sandwich Islands.

The next meeting of the society for scientific business will be held at the society's house, in Hanover Square, on Tuesday, the 21st of January, 1873, at half-past eight o'clock, p.m., when the following communications will be made:—1.—The Rev. John T. Gulick.—On the classification of the *Achatinellinæ*. (Received 19th November, 1872.) 2. Mr. Raphael Meldola.—On a certain class of cases of variable protective colouring in insects, &c. (Received 19th November, 1872.) Communicated by Mr. A. G. Butler, F.Z.S. 3.—Mr. A. H. Garrod.—On the visceral anatomy of the Sumatran rhinoceros (*Ceratorhinus sumatrensis*). Received 5th December, 1872.) 4.—Mr. A. D. Bartlett.—Notes on the birth of a Sumatran rhinoceros. (Received 7th January, 1873.)

VIENNA UNIVERSAL EXHIBITION, 1873.

NOTICE TO BRITISH EXHIBITORS.—CUSTOM HOUSE REGULATIONS.

THE following is an abstract of the rescript of the Imperial and Royal Austrian Ministry of Finance, with regard to the Custom House Regulations to be observed in respect of goods sent from foreign countries to the Vienna Universal Exhibition, 1873, dated August 9, 1872, and published in the *Austrian Imperial Law Gazette*, xlv., No. 127, which has been communicated by his Excellency Baron von Schwarz-Senborn. Her Majesty's Commissioners (office, 41, Parliament-street), have caused a translation of the rescript to be prepared for the information of exhibitors in the British section.

1. The frontier custom houses to direct goods to chief custom house in the Exhibition. Detailed list of contents of packing cases to accompany each consignment. 2. Chief Exhibition custom house office examines goods, and books the detailed lists. Foreign commissions must keep an account of the goods received. 3. Detailed list of contents to specify only goods according to commercial denomination as to kind and quantity. 4. No goods to be allowed to be taken away without permit. 5. Goods going back will be directed by chief custom house to the respective frontier custom houses. 6. Goods remaining in Austria or Hungary are liable to import duty. 7. Goods, owners, and commissions are responsible for the amount. Agents taking charge of goods incur the same responsibility. 8. Discrepancies between contents of packages and the detailed list, and unauthorized removal and sale of goods will be dealt with according to law. 9. Tobacco and goods manufactured thereof are not permitted to be sold in the Exhibition, nor to be brought away for such purpose. 10. Goods not entered for exportation three months after the close of the Exhibition are liable to import duty.

NOTICE TO BRITISH EXHIBITORS.—PROTECTION OF INDUSTRIAL DESIGNS AND INVENTIONS.

1. Exhibitors can obtain a "Certificate of Protection" by applying to the Director General. Application must be made previous to the opening of the Exhibition, or, if later, before the installation of the objects in the Exhibition. It must be accompanied by an exact description of the exhibits, and double copies of plans or drawings, or two specimens of the trade mark, design or model in separate cases. If application be made through an agent, letter or authorization must be added likewise. 2. "Certificate of Protection" is granted gratis, and is valid till 31st December, 1873. Exhibitors can apply for a regular patent, or protection of trade mark or design, before the 31st December, 1873. 3. No appeal against the Director General's decision against the granting or refusal of Certificate of Protection allowed. 4. Double registers of applications and certificates issued will be kept. 5. Certificates of protection will be published in Austrian and Hungarian Official Gazettes. Registers open for inspection to every one. Secrecy observed, if desired.

IRRIGATION IN INDIA.

BY COL. W. H. GREATHED, C.B., R.E., &c.

THE object of this paper, read at the Institution of Civil Engineers, is to describe what has been done, and what is now doing, in that portion of Upper India where irrigation had been longest practised, and on the largest scale. The conditions which created a demand for artificial irrigation were exhibited by a map showing the average rainfall over the surface of British India, distinguishing the rainfall of the North-East Monsoon and of the South-West Monsoon. The tract of country under consideration was included between the Himalaya range on the north, the River Brahmaputra on the east, and the rivers which merged into the Indus on the west. The principal geographical features of the region were the plains drained by the Ganges and the Indus and the intervening table-land of Central India, comprising a country four times as large as France in area as well as in population. The Plains of the Ganges and of the Indus rose gradually from the level of the sea to an elevation of 1,000 to 1,100 feet where those rivers debouched from the mountains, and the highest general level of the central table land was about 2,000 feet. The distribution of the rainfall in India was then noticed. It was very large during the South-West Monsoon along the range of the western ghats, much less in the interior, and it rapidly decreased towards the mouth of the Indus, but it was again larger on the table lands, bordering the valleys of the Nebudda and the Taptee. At the southern point of India and in Ceylon, the South-West Moonson brought but little rain, which, however, increased up the eastern coast of the peninsula, and on the east of the Bay of Bengal there was an abundant fall, which extended over the country between the sea and the Himalaya; thence, in the plains of the Ganges, the rain constantly diminished as the distance from the sea and from the Himalaya increased. These varying conditions of moisture involved different agricultural conditions, which were influenced by diversities of soil and of temperature. The temperature ranged from tropical in the south, with an approximately uniform heat, to semi-temperate in the north, where the summer and winter were sharply defined.

The North-Western Provinces, exclusive of the Benares division, where there were no State works of irrigation, might be described as consisting of three zones:—

1st. The sub-Himalayan tract, north of the River Ranegunga, which was copiously watered by the rainfall on the mountains and by numerous small rivers flowing out of them. Most of these rivers dried up after the termination of the rainy season, but on a great part of the length of this tract a deposit of sand and boulders, forming a continuous belt fifteen miles wide, created a vast filter-bed, which, being bordered on the down-hill side by a band of clay, became a covered reservoir. The natural pressure, augmented by the rapid slope, across which the filter-bed laid, forced water under the clay, and produced a line of springs, on the other side of the clay band, which fed numerous small streams and refreshed the country. The local name of the belt of boulder was "Bhabur," and of the tract which it watered by filtration "Terai."

2nd. The Plains, being the area included between the Ranegunga and the Jumna rivers, and including the Muttra and Agra districts, on the right of the Jumna. This tract had a loamy upper soil varying from sand in some parts to light clays in others. But fine sand was generally found at no great depth. In this tract the drainage ran from N.W. to S.E. parallel to the Ganges and the Jumna, which rivers embraced nearly the whole area.

3rd. The Province of Bundelcund, which sloped from the high table-lands of Central India northwards towards the Jumna. The lands bordering the rivers were dry and stony, and higher than the intervening basins, which consisted generally of rich black cotton soil. There had been a great upheaval of the region near the foot of the table-land; and trap and granite rocks cropped out freely, forming isolated hills of fantastic shapes.

The climate of the North-Western Provinces was exceedingly dry, and hot westerly winds prevailed in April, May and June, during which months vegetation of unwatered plants was apparently suspended except in the case of the melon tribe. The rain-clouds of the South-West Monsoon seemed to travel up the Ganges, and they reached the North-Western Provinces about a fortnight after rain had fallen at Calcutta, when the season of agriculture commenced. The agricultural operations, it was observed, were of the most primitive description, and the crops were liable to fail if the fall of rain was not distributed over a sufficient number of days, or was otherwise deficient. The uncertain crops of the rainy season were Indian corn, and millet of various kinds, which formed the staple food of the agricultural labouring classes.

The rainfall in Hindostan of the winter or N.E. Monsoon was everywhere less than in the summer. It was most felt on the eastern coast, from Madras downwards, and in Ceylon was very copious. On the western coast the only considerable winter rain was between Cannanore and Vingorla. As in the S.W. Monsoon the rainfall of the N.E. Monsoon diminished in the valley of the Ganges as the distance increased from the sea, and became very light in the North-Western Provinces and the Punjab, where it was due at Christmas. If the winter rain was favourable, the barley and wheat had a fair chance, but on unirrigated lands the spring crops of cereals were always uncertain. In the Bundelcund zone, barley and wheat were scarcely ever sown, on account of the exceeding dryness.

The Plains had an average annual rainfall of 26·6 inches—enough for agricultural needs; but as the greater part fell, perhaps, in a fortnight, and there was no rain from September to July, except the Christmas showers, the ordinary crops of the country often failed, and the richer crops were entirely dependent on artificial irrigation. In the sub-Himalayan zone, which had a rainfall of 48·7 inches, rice was successfully produced, without artificial irrigation, in about two years out of three: sugar was less certain under the same condition. In Bundelcund the average rainfall, 33·7 inches, sufficed for the ordinary monsoon crops, but it was especially fickle, and scarcity was in consequence very common in that country.

The people of the North-Western Provinces had practised sinking wells for irrigation from the earliest periods. The depth at which water was found in the Plains varied from 10 to 50 feet below the surface. At the lesser depth a little pit supplied as much water as could be lifted in a day in a jar attached to a light balance-beam worked by men. Two men could keep a plot of an acre watered, but the demand on labour prevented its employment on a large scale. Pits of this description fell in during the rainy season, and had to be annually renewed at the cost of the tenant. Deeper wells, lined with brushwood cylinders, and worked by bullock power, cost from £5 to £18 a piece, and employed six men and three pair of bullocks every day to keep 5 acres watered. The duration of such wells varied, according to the soil, generally between two and ten years, and in some favoured tracts could be constructed without lining. A serious objection to the majority of wells was that they contained surface water only, and did not touch the springs, and if overdrawn they fell in. As a rule, the springs could only be reached by wells lined with brick-work, costing from £15 to £30 a-piece, which cost was almost prohibitory to their employment for irrigation. Where water was plentiful they paid best when made of sufficiently large diameter to allow three or four pairs of bullocks to work at once; in which case they commanded 20 acres of land, and cost up to £80 and £100 a-piece.

In the sub-Himalayan zone, wells had not been much used for irrigation—the people had, instead, dammed the rivers and led off from the dams irrigation channels to the fields; but the consequent stoppage of outfal had water-logged the country, and given rise to malaria. A Bill was now before the Legislative Council of India for the removal of the whole of these dams, on the Government making proper compensation either in water supply from other sources or in money. In the third, or Bundelcund zone, no wells could be sunk for purposes of irrigation, because of the depth of the water from the surface, the poverty of the community, and the scanty population. The amount of land irrigated from some lakes had not as yet exceeded 1,300 acres. Although individually diligent in their own concerns, the natives of Northern India were wanting both in the means and in the mutual confidence requisite for combinations in works of general advantage; and generally, improvements, unless proposed and carried out by the officers of the Government, were not done at all.

Extracts were then given from the official accounts of the famine of 1868-69, describing the desolation in districts unprovided with canals, and the security of those that were irrigated.

The scheme projected for turning all available waters to the greatest advantage was next detailed. The characteristics of the Rivers Ganges and Jumna, which included between them the larger part of the zone of "Plains," were identical. Both rose in eternal snows, and both received large affluents before leaving the mountains. The drainage area of the Ganges was 11,200 square miles, that of the Jumna 7,800 square miles. The flow of water in the greatest floods was respectively 230,000 and 160,000 cubic ft. per second, and when these rivers were at their lowest, from the middle of January to the end of March, the flow was reduced to 4,000 cubic ft. and 2,000 cubic ft. Unfortunately, the period of lowest supply was that of greatest demand. The rivers left the Himalaya on boulder beds, sloping 8 to 10 ft. in a mile, which, after a few miles, were replaced by fine sand, wherein the course of the rivers was constantly varying. Beyond the end of the boulder formation the surface of the rivers was generally about 40 ft. below the adjacent country.

The head works of the Ganges and the Jumna Canals had been fixed on the boulder portion of the river beds on account of its stability, and for facilities for leading and regulating the supply of water. All the water in the rivers in January was required, to obtain which dams were constructed across the perennial streams of the rivers, and at times the whole of the visible water was turned into the canals. Temporary dams of crib-work, boulders and shingle were found to be the most suitable for diverting the water; whilst masonry structures were preferred for the regulation of supply channels. The Ganges Canal was, perhaps, the largest work of the kind in the world. Its full capacity was 6,500 cubic ft. of water a second. The width of bed on the was Solani Aqueduct, 18 miles from the head, 164 ft., and the depth 10 feet. The main channel was 348 miles in length, and it was navigable throughout; the branches were 306 miles in aggregate length, and the distributaries 3,071 miles. A carriage road was kept up on all main and branch canals, and the banks were planted with timber trees. The flow of water per second in 1870-71 was 4,300 cubic ft., and 767,000 acres were watered in 5,061 villages. Irrigation commenced 22 miles below the head works, and was diffused over an area 330

miles long by about 50 wide. The sub-Himalayan drainage, which the canal crossed, was passed partly into, partly over, and partly under the canal. The works in the upper part were chiefly constructed on block foundations, perforated with wells, by means of which they were sunk in running sand to a hard stratum. The Solani Aqueduct spanned a valley 2½ miles in width; its foundations were supported by the pressure and friction of wet sand, and no subsidence had occurred. The slope of the country in the upper part of the canal was much more rapid than that given to the canal beds, a difficulty which had been overcome by masonry ogee falls; in place of these, vertical weirs, with long crests, were being built on new canals. The difficulty of the conditions under which the Ganges Canal works were commenced was detailed, and the functions of the canal officers. The earning of a cubic foot of water on the Ganges Canal, in 1870-71, was £11 per annum; on the Eastern Jumna, £59.

The net income of all the canals in the North-Western Provinces, in 1870-71, after the payment of working expenses, was £182,437, being 6·64 per cent on the capital cost of £2,714,631. Measures were now in progress for reducing the rapidity of the current of the Ganges Canal for navigation purposes; and a commencement had been made in leasing the water-power to persons competent to utilise it.

As there was no water in the Ganges Canal available for extensions, it had been determined to construct a weir across the Ganges at Rajghat, for a Lower Ganges Canal, with a capacity equal to that of the Upper Canal, on an estimate of £1,825,000. The combined system would probably be completed for £5,000,000, and return 13 per cent. The weir across the Ganges at Rajghat would be founded in running sand.

The Agra Canal had been projected for the irrigation of the Muttra and Agra districts, on the right bank of the Jumna, below Delhi. A weir 2,428 ft. long had been built across the Jumna, at a point where a spur of quartz from the Aravali range abutted upon the river. The work had no foundation. It consisted of two parallel masonry walls, 2,428 ft. long, running from end to end of the weir, of which the footings rested on the fine sand of the river bed at low-water surface level. Between these walls, which were 26 ft. apart, stone was packed, and a slope of stone was constructed, up stream with a base of 40 ft. and down stream with a base of 200 ft. Scouring sluices were constructed on one flank of the weir, to keep a clear channel in front of the canal head. This weir, when partially constructed, had satisfactorily withstood the greatest known flood on the Jumna. The Agra Canal had a maximum capacity of 2,000 cubic ft. of water per second, and was designed to irrigate 350,000 acres. For the benefit of the plains and zone east of the River Ganges, an Eastern Ganges Canal was about to be constructed, taken off at the bottom of the boulder formation. This would water 450,000 acres, equal to 35 per cent. of the area of the districts commanded.

In the Bundelcund zone, owing to the granite and trap formations, the rainfall was carried off by the rivers with great rapidity, leaving the river beds almost dry soon after the rain had ceased. The channel of the River Betwa was 1,450 ft. wide and 61 ft. deep near the town of Jhansi. This was often filled in July and August, the flow of water being 700,000 cubic ft. per second; yet, in January, the flow was reduced to 50 cubic ft., which passed through a notch 6 ft. wide. It was intended to build a weir across the River Betwa 26 ft. high. The Betwa Canal would then water 120,000 acres in the Jaloun and Humeerpore districts. The estimated cost was £170,000, and the anticipated return from water-rate 10 per cent. Other weirs were projected across the Rivers Dussan and Keyn, estimated to cost £124,000 and £130,000 respectively, and to return 11 per cent. on the outlay; the weirs would stand on granite sites. Lastly, fifteen lakes in Bundelcund would be made available to water 22,000 acres and to return £2,500 a-year on a capital outlay of £8,200. By these means 700,000 acres would be annually watered in Bundelcund and Jhansi, an area sufficient to ensure the province against famine, and, it was hoped, to restore it to its pristine fertility.

The financial results were then explained. At the end of the year 1871 upwards of a million acres were irrigated from existing works, which afforded a net return of £182,500. The capital expended had been £2,717,000, and the net profit on the whole was 6·64 per cent. When fully completed the cost of the undertakings would amount to about £7,500,000, with a return of 12 per cent. on the capital when the canals were fully developed.

A large system of canals had been projected for the irrigation of the province of Oude, from the River Sardah, and would extend to some part of the Benares division.

In the Punjab, at the foot of the Himalaya, there was a zone of rainfall of 40 in. a year, bounded on the south by a belt where the rainfall was 16 in.; the remaining country to the south was almost rainless. The principal canal in operation was the Western Jumna, an old Mahomedan work. It had paid nearly £2,000,000 clear profit, after repaying capital. The Baree Doab Canal, taken from the River Ravee, was constructed on the model of the Ganges Canal, and was gradually making way.

There were profitable inundation canals on the Indus, the Chenab, and the Sutlej. The Sirhind Canal, now under construction, would cost about £2,000,000, and irrigate a country where rain was very scarce. It was calculated to pay about 9 per cent.

It was observed that whilst the characteristics of irrigation in the North-Western Provinces, Oude, and the Punjab, were much alike, they differed largely from the conditions current in Madras. In Northern India irrigation was carried over the whole country; crops were watered both in winter and in summer, and irrigation afforded the greatest benefit in the winter, when there was little or no rain, but in Madras, canal-irrigation was only effected during the rainy season when rivers were full, and was confined to the deltas at the mouths of the great rivers.

In conclusion, it was stated that about two hundred and fifty engineers, of and above the rank of assistant-engineers, were employed under the Indian Department of Irrigation, in developing the advancement and prosperity of the country.

TELEGRAPH AMALGAMATION.

THE preliminary arrangements for the amalgamation of the telegraph lines east of Bombay are now under consideration, and it is gratifying to learn that the representatives from the various colonies in Australia are about to meet in Sydney to fix upon the amount of subsidy to be paid in exchange for a reduction of tariff, thus showing that the colonies are quite alive to the importance of cheap telegraphy, and are prepared to make large sacrifices to obtain it. At the present time the impression, to some extent, prevails, and the question is being actively ventilated, that cheap telegraphy can be brought about by competing lines; never was there a greater fallacy, and I take this opportunity of warning those who have hitherto done well in their investments to shun proposals having no other justification than mere competition. Already a sixth Atlantic cable is being assiduously canvassed, the idea of its utility is, that it should be laid from Liverpool to New York direct, a distance of 3,200 miles, at a cost of £1,000,000. Now, the new French Cable, for which the money has been subscribed, will be shorter in length by 800 miles, and will possess a carrying capacity of 27 words per minute, or double that which can possibly be attained by a single direct line, as proposed, of 3,200 miles; the actual fact—well-known to electricians—being that after the first 1,000 miles the resistance of the cable is enormously increased. Such technical details as these, though of vital consequence to subscribers, will of course be withheld from any prospectus which may be issued. Investors may also be reminded that the shares of the Great Western Telegraph Company (which undertaking was incubated under the most powerful auspices in Liverpool and Manchester with almost the identical object of this proposed venture) and upon which £8 out of the £20 per share have been paid, are now quoted at 6 to 5 discount. These remarks apply also to another scheme to tap the traffic between Trieste and Egypt. Upon this competitor, for which it is sought to raise as much as £400,000, Sir James Anderson has issued an important letter, which is well worthy the attention of shareholders whose support is counted upon. All these attempts at competition, however absurd they be, draw prominent attention to the great fact that the directors of existing lines must not delay their arrangements for an amalgamation of all Submarine Cable Companies under one great organization. By this means expenses can be reduced to a minimum, and innumerable other advantages would be attained. At present, without the boards of any new scheme, there are no less than thirty-four directors on the lines now working, which practically form but one system of communication between East and West—or, in other words, there is one director for every £298,900 of capital, and no less than 11 of the directors are receiving either double, triple, or quadruple fees by being on separate boards. Such a condition as this cannot continue; it is as unnecessary as it is contrary to the interests of the shareholders, and the latter will, no doubt, at the forthcoming meetings insist upon the question being thoroughly ventilated, and the remedy of amalgamation more extensively adopted. The Board of the London and North Western Railway Company, with a capital of over £60,000,000, does not exceed thirty members, or equal to one director for every £2,000,000 of capital.—From the *Monthly Circular* of Mr. William Abbott, 10, Tokenhouse-yard, London.

THE *Revue de Chimie* states that a M. Petit has invented a cheap substitute for linseed oil for use in painting, which has, it appears, been tried with considerable success by persons who testify to its value. It is said to resist rain, is not cracked by heat, does not peel off from dryness nor with extreme cold, and paintings done with this oil present the same appearance as those done with the natural linseed oil; further, it is said, that it does not give off any appreciable odour.

Those old and popular volumes "Debrett's Peerage, Baronetage, and Knightage" will shortly be issued for the 159th time. The present publishers (Dean and Son) will, we understand, continue them in the form they have appeared in for the last ten years.

APPLICATIONS FOR LETTERS PATENT.

CONTINUED FROM PAGE 2.

On December 20th—3861 to 3873.—C. H. Sidebotham. Arrangements and constructions of school desks and seats, and also of the standards for supporting them.—S. Neville. Ornamenting pressed and blown glass, and apparatus therefor.—L. Simeon and R. Simeon. New or improved method of applying petroleum products to illuminating purposes and apparatus belonging thereto. (com.)—J. Borthwick. Form and method of constructions worms of employed in worm-gearing.—W. B. Williamson. Cases or holders for holding and facilitating the sliding

or cutting of pressed or cooked meats, Stilton cheese, and other provisions.—T. Kennelly. Blow pipes used in soldering and brazing metals and for other purposes.—J. C. Kennedy. Rescue apparatus to be used in ice accidents.—R. D. C. Shaw. Machine or apparatus for loading or lifting, and in some cases for preparing to be loaded or lifted, yard or other manures and other materials into or on carts or other receptacles or places.—H. P. Holt. Locomotive engines to be used either on a permanent way or on common roads and adapted for use also in mines and other underground works.—H. Kesterton. Construction of steam boilers.—T. Penn. Apparatus to be applied to watercloset and other cocks, which apparatus is also applicable as a self-acting releaser for pile-driving machinery and other purposes.—J. Wade. Machines for printing. W. M. Brown. Railways (com).

On December 21st—3874 to 3887.—J. W. Thompson. Lining bands for hats and caps.—B. Coone. Machinery for filling moulds with moist and soft clay and other plastic materials (com.) (Complete specification).—L. Rozsavolgyi. A new system of joints for earring hooks, applicable also to other articles of jewellery (com.)—J. Dodd and W. Peel. Reaping and mowing machines (Complete specification).—F. W. Crossley and W. J. Cross'ey. Machinery for grinding cylindrical and conical surfaces.—G. A. Huddart. Railway brakes.—R. S. Symington. Applying gas for heating purposes, and in apparatus connected therewith.—D. Scottergood. Finishing hosiery and other goods.—W. W. Fereday. Treating human excreta, and in apparatus for working the excreta and converting the same into a dry and highly-concentrated manure.—W. J. Morris Holster and pocket pistols.—J. C. Lones, and J. Lones, and C. Vernon, and E. Holden. Manufacture of axles for carriages, and in machinery to be employed for that purpose.—W. Hope. Application of steam power to the cultivation and movement of land.—A. Prince. Manufacture of asphalte for paving and covering roads and ways, and in the apparatus employed therein (com.)—A. Krieger and A. Cauderlier. Stopper for bottles.

On December 23rd—3888 to 3896.—J. C. Morrell. and J. Proctor, construction of privies and dry closets.—J. Senior Improvement in the process of unhairing and preparing skins or hides to be employed for making or dressing into leather of any kind.—J. W. McCarter. Condensing steam.—W. H. Mitchell and R. Jordinson. Carding engines.—A. Samuelson. Laying asphalte, mastic, or other similar pavement.—N. J. Suckling. Steam generators.—W. Pidding Manufacture of ignitible lights or matches, and in some of the materials of which they are composed, and in holders, receivers, or boxes for holding the same.—P. Conniff. Manufacture of fire-bricks.—J. Brown and B. Brown Hand signal and other lamps.

On December 24th.—3897 to 3918.—W. Mann. Charging and discharging gas retorts.—T. S. Prideaux. Apparatus for regulating the supply of air to furnaces.—I. A. Vacherot. Propelling and steering ships and boats, and in apparatus or means employed therein.—A. C. Henderson. Match box or case for automatically lighting wood or wax matches (com.)—G. Rydill. Construction of apparatuses and in machinery for obtaining and applying heated air to furnaces for the consumption of smoke and the saving of fuel, improving ventilation in rooms, drying animal and vegetable substances, and in the construction of furnaces.—W. E. Gedge. Apparatus or drawing-board for obtaining angular or perspective drawings from right-lined drawings (com.)—F. Zysel. Obtaining and applying motive power.—W. R. Triscott. Construction of pipes for smoking tobacco (Complete specification).—J. Radford. Steam, gas, water, or fluid taps.—W. T. Garnett, John Wheather, and W. Waring. Machinery for combing wool, flax, silk, or other fibrous substances.—E. P. North. Combined tables and reading desks or easels.—F. T. T. Eiben, and G. A. Buckholz. Motive power.—S. Metcalf. Self acting mules for spinning and doubling. G. Haseltine. Trip hammers (com.) (Complete specification).—A. C. Kirk. Steering apparatus, and improved motive-power apparatus for working the same, the said improved motive-power apparatus being also applicable for working winding, hoisting, or other apparatus.—T. Williamson, and W. Walker. Construction of reciprocating steam engines.—L. A. Badin. Closets and apparatus for collecting and disinfecting faecal matters and converting the same into manure or human guano.—F. J. Manceaux. Cartridges for breech-loading small arms.—G. H. Smith.—Method of carbonising clay, plaster, chalk, porous stone, and other like porous materials.—J. Cowie. Writing desks known as secretaires.—A. M. Clark. Breech loading fire-arms (com.)—H. W. Whitehead. Machinery for combing wool, cotton, flax, silk, and other fibrous substances.

On December 26th—3919 to 3921.—T. Williams. Combinations of materials for the manufacture of fire-bricks, retorts, and crucibles, linings for furnaces, cupolas, and vessels in which great heat is employed.—E. T. Hughes. Machines for scouring and polishing needles (com.)—R. Brydon and J. S. Davidson, and T. A. Warrington. Machinery or apparatus for drilling, boring, or cutting rock and other hard substances.

On December 27.—3923 to 3937.—H. Taylor, H. Warburton, T. Taylor, and W. Wadsworth. Combing cotton and other fibrous materials.—C. D. Abel. Paper weights, boxes, and other articles, so as to imitate rouleaux of coin (com.)—W. McAdam. Utilising waste products of chemical works.—H. Copland Formation of roads or ways with wood paving with or without rails, and in apparatus for the purpose.—D. C. Miller. Distilling, evaporating, or concentrating saccharine and other solutions or liquids.—W. Lattimer Apparatus for extinguishing fire.—G. J. Cross. For tramways, railways, contractors', and other carriages, waggons, or other vehicles.—S. Osborn. Prickers to be used in blasting or mining.—R White and P. T. Hendry. Treating liquids to be burned for illuminating purposes (com.)—W. Hutchinson. Construction of washing machines.—J Quin. Manufacture of belting for driving machinery.—J. Quin. Manufacture of solid india-rubber tubing, and in machinery or apparatus employed in such manufacture.—J. M. James. Locks or fastenings for purses, bags, and other like articles.—A. M. Clark. Brick machines (com.)—H. M Phelps Printing telegraph.—H. M. Mellor. Hosiery goods, and in apparatus employed therein.

On December 28th.—3938 to 3946.—G. Rydill. Steam boilers, furnaces, and flues.—R. Williamson and J. Dale. Manufacture of salt, and in apparatus employed therein.—F Garforth. Apparatus for spinning and doubling cotton and other fibrous substances.—G. Bedson. Rolling wire and other rods or bars of metal.—G. Gulliver. Spindles for locks, latches, and other fastenings.—T. Salmon. Apparatus for cutting shoe linings, also applicable to other fabrics.—H. Venman and C. J. Warne. Manufacture of flexible type, inking pads, and rollers used for stamping and printing letters and devices.—C. F. Wood. Machines used in the manufacture of cigars.—W. B. Patrick. Apparatus employed in the process of filtration in sugar refining.

On December 30th.—3947 to 3958.—J. Johnson. Wheels for vehicles (com.)—E. Burstow. New or improved balancing machine and fittings applicable to roller blinds, revolving shutters, and such like articles.—J. Higgin and J. Stenhouse. Treating waste liquors containing arsenical or phosphatic compounds, and in obtaining and applying useful products therefrom.—S. G. Camroux. Receptacles to be used for heating purposes.—H. Mackinnon. Lamps to be used for cooking, heating, and lighting purposes.—R. Longley Means for preventing and removing the scale in boilers.—W. L. Anderson. Means and apparatus for obtaining and preserving equilibrium in vessels and other floating structures, specially applicable to ships' cabins and gun platforms.—W. C. Clark. Means or apparatus for preventing accidents from entering or leaving railway carriages.—J. H. Johnson. Firearms (com.)—J. H. Johnson. Treatment of maize and other like grain for the production of starch therefrom, and in the utilization of the waste products for the manufacture of cardboard and paper and for the preparation of soaps (com.)—J. W. Spencer. Iron.—G. Haseltine. Breaking or tearing rags (com.) (Complete specification.)

On December 31st.—3859 to 3970.—J. Harrington. Treatment of paper and other materials for the production of imitation or artificial leather.—E. H. Cornish and A. Strange, F.R.S. Casks.—E. Day. Means or apparatus employed for removing and preventing the accumulation of soot, dust, or other substances that may adhere to those parts of boilers exposed to the flame or flue or the heating surface of boilers.—W. A. Wood. Mowing and reaping machines. (Complete specification.)—J. Bullough. Safety and relief valves.—G. Spencer and W. M. Smith. Tempering steel.—S. Gomperts. Apparatus for securing the doors of railway carriages.—W. Lees. Regulating and securing the opening and closing of railway carriage and other sliding windows, shutters, and doors.—R. Tweedale. Flyers for roving, slubbing, and other frames.—G. T. Bousfield. Manufacture of steel and in apparatus employed for this purpose (com.) (Complete specification.)—J. H. Johnson. Boots and shoes (com.)—J. H. Johnson. Methods, processes, and apparatus for depositing upon wrought iron, steel, and cast iron layers of copper or alloys of copper (com.)

On January 1st.—1 to 21.—C. W. Harrison. Treating certain gases for lighting and heating purposes, and in combining atmospheric air therewith.—G. Allibon and A. Manbre. Safety valve for steam boilers.—W. Bowker. Looms for weaving.—O. E. Pohl. Apparatus employed in the manufacture of salt.—F. A. Paget. Magnetic compass cards for iron and other ships (com.)—W. Stroudley and D. Drummond. Method or process of casting metals.—D. B. Peebles. Apparatus for regulating and supplying illuminating gas.—J. Van Den Bergh, harnessing animals.—C. G. Gumple. Apparatus for lowering and letting go ships' boats.—J. Gordon. Manufacture of envelopes.—F. Philippi. Smelling bottles.—D. de Castro. Gas meters.—G. Haseltine. Back chain for cart saddles (com.) (Complete specification.)—G. Rawle and W. N. Evans. Manufacture of leather.—J. S. Leigh. Apparatus and arrangements for transporting, removing, and carrying weights and persons from place to place (com.)—J. Cooper. Moulds and mould boxes for casting metals.—C. Boundy. Treating waste products and other materials containing zinc for the purpose of recovering zinc and other valuable products therefrom, and in apparatus to be employed for that purpose.—J. H. Johnson. Spinning machinery (com.)—W. E. Newton. Dies for cutting and cupping or drawing metals and other materials (com.)—A. V. Newton. Paper-ruling machines (com.)—J. C. Wittenbury and J. C. Wittenbury. Convertible school desks.

On January 2nd.—22 to 34.—T. C. Craven. Means or apparatus for preparing cotton for manufacturing purposes.—A. H. Smith Machinery for crushing stone and other substances.—J. Oldknow. Manufacture of fabrics in twist lace machinery.—J. T. Parlour. Cabs and other vehicles. (Complete Specification.)—W. R. Lake. Machinery for manufacturing meal or flour (com.)—W. R. Lake. Brushing machine for cleaning horses (com.)—W. E. Newton. Transposing key-board or manual applicable to pianofortes, organs, harmoniums, and other analogous instruments (com.)—E. R. Morris. Improved instrument for measuring distances on maps, drawings, and for other measuring purposes.—W. Leatham. Construction and arrangement of safety and other valves, and apparatus in connection therewith.—J. Needham. Repeating fire-arms, and in cartridges to be employed therewith.—B. Harrison and E. Conder. Obtaining motive power, and in the apparatus employed therein.—M. Henry. Water guage (com.)—J. Boss. Oven for baking bread and confectionery.

On January 3rd.—35 to 43.—W. B. Stephens. The manufacture of paints.—O. Lowe. Steam boilers.—P. G. Gardiner. Railroad car-springs. (Complete specification).—G. Bischof. Purification of water, and in the means and apparatus employed for that purpose.—G. F. Whiting, and J. C. Bolton. Window fasteners.—B. Hunt. Printing telegraph instruments (com.)—F McClean. Apparatus for raising ships and vessels out of the water for examination and repair.—W. C. Thompson. Process and apparatus for extracting oleaginous or fatty matters from liquid or solid substances.—J. H. Johnson. Transmission of power and in the machinery or apparatus employed therein.

On January 4th.—44 to 56.—S. Buckley. Construction of a combined pipe wrench and cutter.—A. A. Croll. Means or apparatus for the distillation of ammoniacal liquors, which improvements are also applicable to the distillation of other liquids, and in the concentration of soluble salts.—T. Leeming, and R. Ray, and F. G. Lynde, C.E. Machinery for bronzing, colour-

ing, or otherwise ornamenting paper and other materials.—P. Burton. Means and apparatus for opening, closing, and securing the doorways of railway trains.—T. Witburn. New or improved method or process to be employed in printing and reproducing on wood, and on veneers of wood, and on paper mache, designs, patterns, and devices for ornamental and decorative purposes.—T. Aitken. Printing calico and other textile fabrics.—P. Spence. Obtaining valuable substances derivable from residual liquors produced in the manufacture of alum from natural phosphates of alumina.—E. J. C. Welch. Locked safety valve arrangement for marine and other purposes.—W. A. Lyttle. Roofs, partly applicable also to floors and pavements.—H. Kesterton. Rolled tubes, bars, and plates.—H. Kesterton. Construction of metal telegraph posts.—H. Jewitt. New or improved toy (com).—E. Umbers and A. G. Fenn and W. T. Whiteman. Signalling on railways.

On January 6th.—57 to 67.—J. C. Burt. Mechanical arrangements for opening and closing carriage heads.—A. Walker. Steam boilers.—W. Foulis. Charging and drawing retorts and in the machinery or apparatus employed therefor.—G. Turper. Venetian blinds.—C. Bremerkamp. Method of removing by steam the bark from osier, willow, or any kind of rods, and also of improving their colour, and in the apparatus for effecting the same.—F. Garon. Stove for heating conservatories, baths, and similar purposes.—E. T. Hughes. System and arrangements for towing canal boats (com.)—A. W. C. Williams. Apparatus for extracting nails (com.)—J. Fl. Wiles. Means or apparatus for securing the doors of railway carriages whilst a train is in motion.—A. Jaynor. Steering wheels, capstans, windlasses, and other like machinery employed for raising and lowering weights.—W. Robinson. Electro-magnetic railway signalling apparatus. (Complete specification.)

On January 7th.—68 to 76.—J. Argall. Oil paints.—W. Anyan. Construction and fixing of fire-grates for domestic and heating purposes in dwelling-houses.—G. Smith. Ventilating boots, shoes, goloshes, and other coverings for the feet.—J. Law and S. Law. Cards for carding woollen, cotton, silk, and other fibres, and in the machinery or apparatus to be employed in the manufacture of the wire for such cards.—H. Carmichel. Process and apparatus for bleaching, dyeing, and washing linen, cotton, and other yarns and fabric.—J. W. Lamb and S. Lowe. Apparatus for transferring knitted fabrics to circular knitting machinery.—C. H. Adamus. Tea kettles.—H. Codd. Manufacture of glass bottles, and apparatus employed therein.—W. Wilson. Manufacture of hats (com.)

On January 8th.—77 to 93.—G. Haseltine. Hospital beds (com.) (Complete specification.)—R. Baynes. Apparatus for heating the feed water of steam boilers.—W. R. Lake. Thread spools for sewing, embroidering, and other machines (com.)—W. R. Lake. Improved apparatus for manufacturing illuminating gas (com.)—R. Hartley. Machinery or apparatus employed for singeing yarn.—G. Hydill. Drying machines for drying animal and vegetable substances, earth and compositions, part of which are also applicable for furnace bars and other purposes.—W. E. Wiley. Coating metals, and in machinery or apparatus used for that purpose.—A. T. C. Schuevers. Trusses for the cure or relief of hernia.—H. Highton, M.A. Electric telegraphs.—T. Whitwell. Register and other fireplaces.—J. R. Chislett. Apparatus for employing electricity for curative and remedial purposes, and in appliances to be used in connection therewith.—G. Steinhoff. Hammer for impressing or printing numbers, letters, or other marks in or upon timber and other substances, and an improved inking or coloring apparatus in connection therewith (com.)—W. E. Newton, C.E. Water wheels and mounting the same, parts applicable to mounting other driving shafts (com.)—W. E. Newton. Puddling furnaces (com.)—S. W. Konn. Producing heat by electricity (com.)—H. Macaulay. Breech-loading small arms.—H. F. Hodson. Combination implemements for gardening and other purposes.

On January 9th.—94 to 98.—L. Roberts. Manufacture of rails.—P. Gay. Machinery for cutting or excavating coal, stone, or other minerals.—P. Hughes. Construction and formation of dishes and plates.—R. Thwaites and L. Stephens. Corks, and in the form of the necks of bottles to be used with the same, and the method of using the same for bottling liquids.—L. W. Boynton and J. E. Holmes. Centrifugal machines, and kilns and apparatus connected therewith for drying and charring peat, and for other like purposes.

On January 10th.—99 to 109.—E. Cowles. Cooling bundle moulds and apparatus therefor.—A. Sowerbutts. Apparatus for raising sunken vessels and other submerged or partially submerged bodies.—M. A. Soul. Mechanism for turning the leaves of music books.—J. Kininmouth. Heating bakers' ovens and in the apparatus employed therefor.—A. Seiferheld. Machinery or apparatus for blocking the soles and heels of boots and shoes, and improved apparatus in connection therewith (com.)—W. E. Gedge. Water meter (com).—M. Knowles and D. Barnes. Looms for weaving.—G. Pritchard. Machinery for straightening, smoothening, and finishing round metal tubes and bars.—R. W. Page. Apparatus for cutting screws.—R. F. Donnisthorpe and T. A. W. Clarke. Crimped hair, and in apparatus employed therein.—A. M. Clark. Method of and apparatus for condensing liquifiable matters contained in gases and vapours.

On January 11th.—110 to 128.—F. Cole and R. G. Acton. Apparatus and arrangements for using air as a motive power.—S. Stell. Apparatus for the prevention of dense smoke being emitted from the chimneys of steam-boiler and other furnaces, and for economising the fuel consumed in such furnaces.—S. Ullmann. Trousers and their suspenders.—F. Aylward. Lowering and disengaging ships' boats.—G. Charlesworth. Power looms.—S. Holman. Gas retort mouth pieces, lids, and fastenings.—J. A. King. Peat fuel and peat machinery or apparatus.—T. Wright. Jacquard apparatus.—W. Jones. Valves for regulating the flow of steam, water, and other fluids.—R. H. Gibson. Desks and seats applicable to the use of schools and other purposes (com).—Sir S. Canning. Transmitting signals, steering and engine room telegraphs.—C. Harrison and W. Pearson. Frames for umbrellas, parasols, and sunshades (Complete specification.)—W. H. Crispin. Apparatus to be used in connection with reverberatory and other furnaces.—J. L. Mills and T. S. Monkhouse. Printing and cutting-up printed matter simultaneously.—T. J. Smith. Locomotive and other boilers, and means of effecting economy in the consumption of fuel therein (com).—J. Walpole. Double-furrow ploughs. G. Haseltine. Projectiles for rifled fire-arms and ordnance (com.)—W. R. Lake. Stove and other pipes, and elbows or couplings for the same (com).—G. Haseltine. Machinery for rolling iron or other metal (com.). (Complete specification).

On January 13th.—129 to 140.—W. Turton and H. Rogers. Construction of vehicles for conveying passengers and luggage.—G. P. Lanier. Summer or bed bottom (com).—E. A. Cowper, C.E. Machinery for sewing a sole onto a boot or shoe.—J. Whipp and W. W. Mellor. Glass cutters.—W. B. Smith and J. Sturley. Sewing machinery.—F. J. Trippe. Machine for cutting textile fabrics into small portions for patterns, samples, and other purposes.—J. Norman. Means or apparatus for clipping horses and other animals.—S. Holman. Apparatus for raising and lowering heavy bodies, particularly applicable to the lids of gas purifiers.—A. Watson. Thrashing machine and elevator.—W. Scott and W. J. Matthews. Breech-loading small-arms.—C. Asbury. Tubular steam boilers, and furnaces for steam boilers.—J. G. Tongue. Imitation or composition slates, tablets, and other surfaces for writing, drawing, and marking upon (com).

On January 14th.—141 to 156.—W. B. Quelch. Apparatus for heating and ventilating rooms and buildings.—S. Hunt. Building block.—W. Alleaby. Harmoniums.—J. T. Parlour. Wheels and bearings for the same, chiefly designed for omnibuses, cabs, waggons, and other similar vehicles (Complete specification).—G. W. Bentley and R. F. Garth. Treating hides.—W. Pitcher. Craping hair and other fibrous materials, and in the machinery employed therein.—P. Salmon. Steam boilers and oil-gas apparatuses, and in oil-gas engines and boilers, and in the apparatuses connected therewith, partly to warm, ventilate, and light railway carriages and other vehicles.—W. Sutcliffe and G. Clayton. Miners' safety lamps.—P. Jensen. Automatic telegraphic printing apparatus (com.)—R. Quintavalle and W. T. C. Pratt. Method of fixing a reserved rudder (in case of loss of the original one during a gale or from any other cause) with very little delay.—R. Wood. Weaving.—H. L. Power. Umbrellas.—W. H. Preece. In the mode of and apparatus for signalling on railways.—Major-Gen. H. Y. D. Scott, C.B. Treatment of sewage, and of the deposits obtained therefrom.—J. H. Johnson. Mechanism for breech action in breech-loading rifles and other descriptions of fire-arms. (com.)—W. T. H. Carrington and J. Platt. Domestic fire-grates to facilitate the economical burning of fuel therein.

On January 15th.—157 to 171.—H. E. Delessert. Improved carriage.—W. A. Lyttle. Permanent way of railways.—T. Fawcett and J. Coulter. Governor for motive-power engines (Complete specification).—J. Owen. Machinery or apparatus for the prevention of accidents in ascending and descending shafts of mines, which improvements are also applicable to hoisting and other lifting machines.—T. Fuller, M.D. Apparatus to be used in fitting tops to billiard cues.—G. Davis. Ships' davits for shipping, unshipping and lowering and raising boats or anchors, and other analogous purposes.—J. Woolbright. Window-sash fastener.—H. Jarman. Right and left hand mechanical movement applicable for steering apparatus for ships and other vessels, and for other purposes.—E. Hipkins. Iron safes.—J. W. Wattles. New and useful improvements in machinery for spinning (Complete specification).—W. Bottomley and M. Naylor. Weaving.—J. L. F. Target. Treating excreta and sewage matters, and apparatus employed therein, parts of the apparatus being also applicable to the drying and charring of other matters.—T. Turton. Hydraulic propellers for navigable vessels.—R. Scholefield. Brick-making and pressing machinery.—A. Bullock. Apparatus for preventing incrustation in steam boilers.

On January 16th.—172 to 189.—J. Larue. Multitubular block printing apparatus, also applicable to cylinder printing.—C. E. Parker-Rhodes. Illuminating public and other clocks, street and other names, professional and trade signs, and all other signs and things publicly exhibited (Complete specification).—H. A. Bonneville. Spinning (com.) (Complete specification).—J. Wright, C.E. Heels for boots and shoes (com.)—G. Glen. Tramway cars and rolling stock for tramways or railways.—C. E. Hugall. Opening, closing, and fastening windows, and apparatus therefore.—G. Hindley. Dressing stone.—J. Barnett. Machinery for obtaining motive power.—J. M. Plessner, late Captain in the Prussian Army. Filling or feeding lamps with liquid fuel, applicable also to the filling or feeding of other apparatus used for burning such fuel.—J. T. Hopkinson. Window sashes.—M. A. Wier. Registering and checking the entries and exits of passengers to and from tramway cars, omnibuses, or other carriages.—Major-Gen. H. Y. D. Scott, C.B. Purification of coal gas.—R. Macneill. Improved pavement.—T. P. Coubro. Cutting and making up sails of the character of jib and stay sails.—W. S. Lecon. Lowering ships' boats.—E. C. Hamilton, W. R. Preston, and H. Jones. Artificial manure.—G. Horner. Hackling flax and other fibrous materials.—A. M. Clarke. Velocipedes, and producing rotary motion (com.)

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ESTABLISHED 1st MAY, 1862.

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HELD AT

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

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*** In this list (Com.) means Invention communicated from abroad.

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Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE.

MARCH 1, 1873.

FREEDOM OF CRITICISM.

"Britons never shall be slaves" is the cuckoo-cry of our port-wine politicians, oft resounding in the ears of after-dinner audiences, who frequently take it up with musical honours, fully expressive of appreciation of their own superiority over the unhappy people belonging to nations "not so blest" as that of the free-born Briton. Notwithstanding all this, when one is no longer at "high jinks," but soberly pursuing, with observant mind, the practical business of life, it becomes a matter of some difficulty to ascertain exactly how, and in what, it is that the subjects of this realm differ so advantageously from those of neighbouring States in this matter of freedom. They certainly have considerable latitude as to religious worship—so much so indeed that, even what is termed the National Church by law established, is liable to be transformed into an arena for the exhibition of the ultra-dogmatic and ceremonial vagaries of its ministers whenever they think it worth their while to attract attention and gather up pecuniary help for these vagaries by appealing to the prevailing love of novelty and sensuousness. Indeed, in the various ways in which a man may make a fool of himself, considerable latitude is still allowed, and even some protection is by law accorded; for it has *quantum suf.* of pains and penalties in store for anyone who dares, in regard to another person, to "write him down an ass." But, in other matters of personal liberty, the amount of freedom which the excessive multiplication of petty legal restrictions has left us is by no means large; there are but few actions of ordinary every-day life in which the officers of Law and Order cannot authoritatively intervene—from the knocking at one's own door and ringing one's own bell to the firing off a gun in one's own garden. In short, the modern invasions of personal liberty are only saved from becoming practically unbearable principally in consequence of the great number and bewildering variety of these restrictions preventing our police officers from having any clear conception of the wide extent of power entrusted to their use, of which their batons are the forcible symbols.

Perhaps nothing is more often boasted of than our freedom of speech and freedom of the Press; but it will be found, upon examination, that even here there is more of the appearance than the reality of freedom. Not only are we restricted as regards public speech in public parks and other places of public resort, but, according to recent legal decisions of high authority, we must not open our mouths in regard to any matter which may be pending in our Courts of Law, and must reserve the expression of our views and opinions till the matter has been [illegible], when they will be of no value as [illegible] to the state.

As to private speech, we are just as closely "[illegible], cribbed, confined" as in public speech. It is legally dangerous to warn anyone against the dishonesty of another; and to tell a man of his faults may possibly render the teller liable to criminal punishment as a provoker of a breach of the peace. As to the freedom of the Press and of public criticism—which, now that we have undertaken to range through, not only the fields of science, but also those of literature in general, is to us a subject of practical importance—how do we stand? We have not, it is true, any Censor of the Press, nor do we receive police warnings; but we have to write, so to speak, with halter round the neck in the shape of a possible prosecution or legal proceedings against us if we greatly displease anyone whose works we criticise; and when we find, as in a recent case, large damages, with heavy law costs, is the punishment meted out for severity of criticism, we begin to feel that an editorial chair is likely to be, in time to come, no bed of roses for ourselves, however we are firmly resolved to do our work honestly and with all the ability we possess—avoiding timorous reticence on the one hand and excess of duty on the other; seeking, if possible, to attain to better friendship with friends and to the respect of foes, if we should be unfortunate enough to make any. Certainly, in no case shall we ever allow our criticisms to be swayed by personal prejudices or extreme views of our own; for, although we are the advocates of freedom and liberty, we are utterly averse to the licentious abuse of those most sacred rights of humanity. Still, when we find, as in more recent cases, that there is no certainty whatever about the result of Press prosecutions or anything connected with the position and liabilities of publishers—as it appears that a person libelled or aggrieved, if he has been outspoken in his enunciation of views of the position of our political or social systems which are distasteful to what are termed the "respectable" classes, rendered himself obnoxious, he will find that the sympathies of almost everybody are against him, and the result may be an adverse verdict or a nonsuit. So that prosecutions of this kind seem to have more of the "glorious uncertainty of the law" about them than even patent cases or horse cases.

Indeed, if any coherent system in reference to these matters can be eliminated from all that passes in our Courts of Law, and amongst those who rule over us, it would appear to be a system which shall secure that no expression of public opinion shall be legally allowed except it finds utterance on the Judicial Bench, within the walls of Parliament, or by the deliverances of our governors. At present, however, people look to the public journals for expressions, if public, and "Othello's occupation's gone" if a journal refuses to publish any such expressions.

We do, therefore, hope that our Legislature will be pleased to consider the state of our libel laws, and so provide that, when fairly and honestly endeavouring to perform a public duty a man may not be liable to a ruinous penalty for simply being mistaken as to the scope of that duty—in short, be called upon to bear a heavy punishment for a small offence.

Reviews.

Recent and Actual Commerce, 1789-1870. Also, The Growth and Vicissitudes of Commerce, B.C. 1500—A.D. 1789. By Dr. YEATS, Assisted by Several Gentlemen. London: Virtue and Co.

DR. YEATS treats any subject he undertakes to handle in such a thoroughly exhaustive manner, and with so much detail and comprehensiveness, that it is very difficult to present the public with such a Review of his works as shall enable any one to form a correct idea of the value of their contents.

Doubtless, the present works are in a great measure compilations, and when the reader has perused them he will be in possession of all that has been published on the matter treated by nearly every writer worthy of attention.

The following quotation from "Recent and Existing Commerce" relates to the little kingdom of Belgium, whose industrial enterprise, commercial activity, regard for the rights of inventors, and liberal, one might even say, orderly, yet almost democratic, political system, renders it a pattern State for Europe.

The resentment of the Dutch for many years interposed an additional barrier to friendly dealings. The capital invested in Belgian enterprise was withdrawn, and much of the trade between the two countries entirely ceased. Such was the case with coal, which the Dutch formerly obtained from Belgium, but now receive from Germany. Belgium had also to assume a considerable portion of the Dutch debt, amounting to 83,000,000 guilders, and an annual contribution of 400,000 guilders. Thrown on its own resources, the little kingdom did not despond. It possessed many countervailing advantages. It had the densest population in Europe, so closely packed that Philip II. once exclaimed of the country, "This is but one great town." Its roads and canals were admirable and numerous, and rendered carriage everywhere easy. To these means of communication was added a well-devised railway system, carried out with skill and economy, under the control of the Government, at a time when England was wasting enormous sums over railway schemes devised on no regular plan. The people were happy in their king and government, for although there could be little national feeling amongst races that differed in their origin and language, and had been governed by foreign powers for several hundred years, yet the new constitution was well administered, and the reigning prince devoted himself to the prosperity of his adopted kingdom. The sentiment of loyalty implanted by the king has taken root, and the people are now as proud of being Belgians as once of being inhabitants of Bruges and Ghent. To meet the deficiency of capital the Government instituted a society (Societe Générale de Commerce), with powers to make advances for carrying out industrial objects, and also founded a national bank. By these means new undertakings and manufactures, some of an extensive nature, were encouraged and sustained. A series of reverses occurred in the years 1837 and 1838. Numerous mercantile failures took place, a brief panic ensued, and the Belgian bank suspended payment. The resources of Belgium were happily too sound and certain for the national prosperity to be permanently injured. The crisis stimulated the people to seek new routes for trade. Commercial intercourse with France was gradually resumed, and in the course of a few years this trade was nearly equivalent to all the rest of the foreign traffic of the country.

Commercial intercourse arose with Austria, the shipments being chiefly cloth to the port of Trieste, for further consignment. Belgian vessels visited the distant empire of Brazil, and the English settlement of Singapore: but very little profit appears to have resulted from these ventures, as a commercial treaty with Brazil was not considered worth renewing in 1841, and the intercourse with Singapore has fallen off.

Time soothed the ill feeling between Belgium and Holland, and a renewal of commercial intercourse benefited both kingdoms. Cloth, coal, iron, metals, glass, and furniture were taken by the Dutch; the Scheldt was again opened to vessels of Antwerp; and a treaty of commerce was concluded between the two kingdoms, whose relations continue to be altogether amicable.

In husbandry and its connected manufactures, the cultivation of flax, and the making of linen, rank first in importance. To increase the growth of the fibre, and to seek the most improved modes of its manufacture, are objects of solicitude with the Government. Extensive mills, with the newest inventions in machinery for spinning flax, were erected as early as 1834, and the industry expanded every year, till 10,000,000 lbs of the fibre, of the value of 25,000,000 florins, are annually produced. Three-fourths of this quantity keep the national spinning mills and looms in activity, while 10,000,000 lbs. supplied the foreign demand for yarn.

Brussels, the industrial as well as political capital of Belgium, produces a variety of fabrics, of which its lace and tulle are unsurpassed. Lace-making, in particular, has, for many generations, been a costly and beautiful art, to which the taste for luxury in dress, prevailing throughout Europe, and created by the rapid accumulation of wealth, has given an extraordinary impetus. Wool and woollens form another important industry in Belgium. Fine cloths used to be amongst the most eagerly sought-for products of Flemish skill. The long period of Spanish oppression reduced this manufacture to its lowest point, but with freedom it has again risen to be second only to that of linen. Neighbouring countries have, however, in the meanwhile, so improved their woollen cloths, that Belgium has not yet resumed its former place in the markets of the world. A large quantity of cloths is sent, notwithstanding, to France, and also to the United States. Cotton manufactures, in consequence of the fibres being imported from England, advanced slowly at first, but have now become of even more importance than the flax and woollen industries. Metal working is the next great manufacturing industry of Belgium. This is facilitated by the great stores of coal, which, excepting those of England, are the most abundant in Europe. On account of the almost vertical tilt of the strata, the coal is obtained from a continually deeper depth, and not laterally, as in English mines. The mineral resources of Belgium appear to be without limit, and the skill exercised is such that some of the English iron trade has gone thither, and England herself has been supplied with locomotives from Liege, a town sometimes called, from its iron works, the continental Birmingham.

Belgium has made unavailing efforts to plant colonial settlements. The present king, when Duke of Brabant, showed great interest in such designs, and continues to favour them. Even without colonies, the kingdom has commercial relations with every country in the world. Its chief trade is with France. In 1865 this had risen to the value of nearly £18,000,000, imports and exports combined, or between thirty and forty per cent more than it was in 1861. With Great Britain, in the same year, the value of the commerce was above £14,000,000, an increase of nearly £2,000,000 over that in 1864. The Belgian trade with Holland, Russia, Germany, and the two Americas is likewise very extensive, and continues steadily to increase. Belgium exports to France cattle, coal, linen, and woollen fabrics, and receives in return cereals, wines, flax, silks, and wool. The chief imports from England are cotton and yarns, besides many miscellaneous articles. Amongst the exports to England are those contained in the following table:—

In 1870 Belgium supplied:—

Cattle, sheep, and swine ..	146,000	head.
Meat, and poultry, and game	3,092	tons.
Eggs	15,000,000	
Fruit	11,479	tons.

This provision trade has declined of late years, although the general trade of Belgium with England has largely increased. The value of exports to England in 1870 was £11,247,864, and of imports of British produce and manufactures, £4,481,079.

We have no space for further quotation at present, and will, therefore, conclude this review by saying that those who wish to become fully acquainted with the past and present position of Commerce and Industry should consult these works of Dr. Yeats.

Physical Geography for the Use of Beginners. By WILLIAM HUGHES, Professor of Geography in King's College, London: Author of "A Manual of Geography," &c. [Gleig's School Series.] London: Longmans, Green, and Co. 1873.

MR. HUGHES' reputation is so high, that when we say this is a most valuable educational work, we shall only be making a statement that every one would expect to find recorded in our pages. Mr. Hughes truly says, "The most satisfactory feature in the geographical tuition of the present day is found in the increased attention given to the study of the earth's natural aspects, phenomena, and productions—in other words, to Physical Geography. It is in good books of travel, the work of competent observers of nature, that the best materials for satisfying the want thereby created on the part of the learner are most readily found, and it is from such sources—aided by the experiences and generalisations derived from many years devoted to tuition, as well as to geographical inquiries in general—that the writer of this 'Physical Geography for Beginners' has drawn the aid necessary to his purpose. In its general design and mode of treatment, the plan followed is in harmony with that pursued in the case of the descriptive geography which formed one of the earlier numbers of Gleig's Series—'Geography for Beginners'—by the same writer.

We must, however, confess that we are no admirers of the plan of separating Physical Geography, which is the "dry" part of the subject, from General Geography, which is more captivating to the student. And we would suggest that if science-education could be pursued in a somewhat similar style to that adopted by Rev. W. S. Symonds in his "Records of the Rocks," formerly reviewed in our columns (see page 4, present vol.) it would lighten the work of both teacher and student.

The work treats successively of the Aim of Physical Geography; Land and Water; Mountains and Highlands; Lowlands; Rivers and Lakes; the Ocean; Climate; Geographical Distribution of Plants and of Animals; Earthquakes and Volcanoes; Geographical Distribution of Man, &c.

Catechism of Zoology. By Rev. J. F. BLAKE, M.A., F.G.S., Mathematical and Natural Science Master, St. Peter's School, York. London: Longmans, Green, and Co. 1873.

THIS is a useful little work of an elementary character, referring to a branch of knowledge which has far less attention bestowed upon it than it deserves. From its preface we learn that it is intended to contain such main facts only as it may reasonably be hoped may be retained in the memory of such as have gone through a course of Zoology, until by the study of particular branches they can verify or supplement them by their own observation.

It is not intended to be used alone, but as a summary of what has been enlarged upon

by a teacher or related in a text-book. It may be also useful as furnishing categorical answers to questions which can only be answered by inference in many cases from an ordinary text-book.

Nowhere more than in Natural History is it true that no rule is without exception—such exceptions to a general statement, when considered important, have been indicated by the qualifying words, "almost," "generally," &c., but some have been passed over as tending to confuse the idea of the general truth.

The classification adopted is nearly that of Nicholson's Manual, to which the author acknowledges himself to be much indebted, but modified, where thought advisable, with the authority either of Owen's "Comparative Anatomy," Huxley's "Outlines," or Rolleston's "Forms."

These intentions and views Mr. Blake has satisfactorily succeeded in carrying out

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Prize Essay on the Balance Spring and its Isochronal Adjustments. (Baroness Burdett Coutts's Prize.) By MORITZ IMMISCH. London: E. and F. N. Spon, 48, Charing Cross. New-York. 446, Broome-street.

[CONTINUED FROM OUR LAST.]

The detached escapements, as they were invented and gradually improved, reduced the friction, that great enemy to steady motion, to a minimum. The emancipation of the balance and spring from the influence of the maintaining power permitted the conditions of their motion and their relation to each other to be considered as separate features; by means of inferences the remaining friction in the escapement became a known quantity with determinable limits which could, by turning the acquired knowledge of the properties of the spring to a proper account, be successfully contended with; and what was before quite illusory the realization of the much-cherished idea of determining the longitude by means of a watch—became now more feasible. We see watchmakers of that period exerting their utmost skill to attain that end the large reward connected with it no doubt acting as a powerful stimulant to their energies.

The spirit of controversy being aroused various and sometimes contradictory theories were advanced in books and pamphlets. The principal aim still seemed to be the further perfection of the escapement, and it makes one sad to think that so much incessant labour should have been thrown away without directly furthering the end in view, as, for instance, in the case of Mudge, who constructed a remontoir escapement so bold and original in conception as to find, simply considered in the light of an ingenious mechanical contrivance, scarcely a parallel in the whole history of watchmaking.

This memorable period of competition was, notwithstanding the frequent mistakes, productive of results extremely salutary to the advancement of horology as a science. Failures of some artists served as examples not to be followed, marking a path to be avoided, and inducing others to look for success in other directions.

The detent escapement being almost exclusively adopted for chronometers, as combining the least friction with the greatest simplicity, the balance spring now received a greater share of attention than heretofore.

Up to the time of Arnold, balance springs were made in the flat spiral shape. With him originated the cylindrical helical spring. The ends of this spring are bent inwards, forming a curve, within the circular space of the coils; the greater or lesser abruptness of these curves affects greatly the action of the spring in long and short vibrations, and is therefore determinable by the exigencies of each case.

Somewhat later the Breguet spring made its appearance, deriving its appellation from its inventor. The body of this spring is flat, but the outer coil is bent upwards with a gentle sweep; at some distance from the flat part of the spring it again forms a knee downwards, in order to bring its lengthy parallel to the plane of the spring; from there it is bent inwards, forming a curve gradually tending toward the centre, similar to that formed by the ends of the helical spring.

I have to mention another spring, which, on account of its form when seen sideways, is called the spherical spring. It was invented by Houriet, a Swiss watchmaker. While in the cylindrical helical spring all the coils, except the curved ends, are of equal diameter, the diameters of all the coils of a spherical spring are different from one another, being largest in the middle and lessening towards the ends.

The specific advantages and disadvantages of these different forms of springs will hereafter be gone into.

I may here mention that the cylindrical form has, with very few exceptions, been adopted by English makers for marine and pocket chronometers, and the high reputation of superiority the English chronometer enjoys, and always has enjoyed, speaks volumes in its favour. One of the principal advantages afforded by this form of spring consists in the facility with which it permits those manipulations to be performed which are necessary to enable the spring so to control the motion of the balance that the long and short vibrations are performed in equal times.

This state of uniformity is called isochronism. We find that it is practically impossible to procure equal arcs of vibration for any length of time the gradual increase of friction on account of the thickening of the oil will soon make the vibrations fall off, and in the case of pocket watches, the motion imparted to the balance while being carried and the varying friction in different positions cause a considerable fluctuation in the length of the arcs, and as, in order to obtain a steady rate of going, any given number of vibrations, whether long or short, must be performed in a given time, it is evident that isochronism is the most important feature connected with balance springs.

After alluding to the diversity of opinion, existing as to the principles of isochronism, the author proceeds:—

One of these so-called principles is the prevailing idea that isochronism solely depended upon a certain length of the spring; that too short a spring made the small vibrations slower than the long, and too long a one caused the watch to lose in long vibrations. This is so far from being correct, that sometimes in the case of a very long flat spring, it is a matter of the greatest difficulty to make the long vibrations slow enough to arrive at isochronism, while a shorter spring offers more scope for any manipulation tending to that end. Everyone with some experience in timing, knows that mere length has absolutely nothing to do with isochronism, and if, nevertheless, we frequently meet with this assertion in books on watchmaking, it proves that it was simply copied from other books, without having been tested by the writer.

Another very general idea is that isochronism is an inherent property of the balance spring. This is also incorrect, and to assume that, because by means of the spring isochronism can be arrived at, the conditions constituting isochronism must be looked for in the spring, is not quite but nearly as wrong as if anybody was to assert that, because licorice cures cough, the conditions constituting cough must be looked for in the licorice.

I have already mentioned the difficulties Cumming, nearly 100 years ago, experienced in accounting for the different performance of springs when in connection with different escapements, and the very natural and sensible conclusion he came to; and although escapements of the present day are far superior to those of that time, there still exists sufficient difference between them to make it a matter quite out of question, for instance, that a balance and spring perfectly isochronous while attached to a chronometer should retain this quality when attached to a lever escapement, unless it was by the merest chance, *viz.*, if the chronometer was badly constructed and the lever escapement in a state of perfection, the difference being so proportioned as to make the sum of friction in the one amount exactly to that in the other, otherwise, and under ordinary circumstances, the balance spring perfectly isochronous in the chronometer would be sure to perform the long vibrations quicker than the short ones in the lever watch; but it is not at all necessary to bring the balance and spring in connection with different escapements in order to prove that the resistance in the escapement modifies the isochronal conditions, as carefully conducted experiments with one and the same escapement will show that every increase and decrease of friction affects the motion of the balance in long or short vibrations more or less sensibly.

A still greater factor in this respect is the balance itself, and before I consider it in its relation to isochronism, I think it advisable to make some general remarks concerning it.

When a balance without a spring is brought into connection with a chronometer escapement and turned in the direction of unlocking, the escapement will cause it to revolve round its axis. There is first of all a certain amount of force required to overcome the *inertia* appertaining to all bodies at rest; *this is a dead loss*, and irrelevant as this may seem to many who have applied themselves to the study of the laws of isochronism, there will also be those who, by inference and actual observation, have found that great importance attaches to this point, and that it bears directly upon the subject of isochronism, as will appear hereafter.

The impulse given, the balance revolves round its axis with a speed greater or less according to the greater or smaller proportion the propelling power bears to the resistance to be overcome; after a whole revolution it presents itself to another impulse, and arrives at this point with a velocity somewhat less than that with which it started, the loss arising from the friction of the pivots, the resistance of the air, and the unlocking of the escapement. To this velocity another impulse is added, which causes the second revolution to complete itself much quicker than the first; the diminution of speed caused by the retarding influences already mentioned, is now much less apparent, as the greater momentum acquired by the balance enables it to overcome them easier, and soon the balance acquires so much force of its own as to leave no perceptible trace of lessening of speed between the commencement and the end of each revolution. This is, however, under the presupposition that the balance is of some considerable weight and diameter: different balances will behave very differently in this respect, a more substantial one has a greater capacity for retaining and accumulating any force transmitted to it, and will consequently exercise a greater controlling power over the impediments in the way of uniform motion.

In all cases, as impulse is added to impulse, the velocity will go on increasing until a maximum is reached, where the speed remains stationary. After what has already been said, it is evident that a slighter balance, owing to its more yielding nature, will arrive at this point of uniformity sooner than a more substantial one; but irrespective of the time required by different balances to arrive at this maximum state of velocity, that state itself is determined not only by the sum of the various influences already mentioned, but also by the inertia of the escape wheel and train, which has first to be overcome by the motive force, causing a loss of time.

This loss is of no importance when the

motion of the balance is slow, as the acting tooth of the escape wheel will then come in contact with the pallet as soon as the latter has fairly entered the circle of the former, and the balance receives the full benefit of the impulse as it is acted upon through the greatest possible arc; but as the velocity of the balance increases the pallet will enter the circle of the escape wheel quicker and will have proceeded farther in it before the sluggishness of the escape wheel and train has been overcome, and in proportion as the "drop" increases, the effectiveness of the impulse decreases, until at length it is counterbalanced by the above-mentioned retarding influences, and the motion remains stationary. It may be as well to mention here that in the case of maximum speed, the resistance of the air is a more important retarding agent than when the motion is slower, as it increases in the ratio of the squares of the velocity.

All these conditions determining the limits of the various influences acting upon the simple motion of a balance, remain in full force when this balance is connected with a spring. In the case of a *vibrating* balance the number of these conditions is naturally augmented by circumstances originating with, and various properties appertaining to, the spring.

Mr. Immisch further considers the principles of the balance spring, and afterwards gives detailed particulars as to the construction and action of balance springs, in some instances supplying illustrative engravings.

General Literature.

Notes of Thought. By the late CHARLES BUXTON, M.P. Preceded by a Biographical Sketch. By the Rev. J. Llewelyn Davis, M.A. John Murray, Albermarle Street

THE biographical sketch furnished by Mr Davis for this volume is a model of plain, honest, manly writing. It is not critical in the ordinary sense, that is, the writer does not sacrifice his subject to himself by a conceited appraisement of his powers and qualities or any dogmatic assertion as to the position Mr. Buxton is to occupy amongst the notable men of England in the present or the future. Mr. Davis tells his story without any kind of pretension, and with as near an approach to a just and, at the same time, an appreciative estimate of his friends character as a man and as a writer as interests the reader by its warmth, without in the least offending him by any undue partiality.

There can be no doubt that the late Charles Buxton was a kindly, affectionate, benevolent, and observant man, who saw clearly what was passing around him, and jotted down his remarks on men and things in a clever, readable way. His personal peculiarities were not very striking. His love for dumb animals being shared by large numbers without perhaps extending to rattlesnakes, and even Mr. Buxton's wide affections gave way before these reptiles. Charles Lamb spoke of his imperfect sympathies because he could not, without an effort, include Scotchmen and Jews amongst his most intimate personal friends. Mr. Buxton went far beyond this, however, and in all directions made friends of men, beasts and birds; of every creature, in fact, in which the capability of loving or suffering could be supposed to exist.

The "thoughts" which constitute the chief portion of this volume are frequently acute, sometimes common-place, often not very accurate, and seldom, if ever, profound. Still they are written in a spirit so kindly and charitable, so free from cant or bigotry of any kind, so shrewd and pleasant in relation to the daily occurrences of life, as well as to the general run of public questions, that few readers will close the book without being pleased and improved by its perusal. Some of the longer "notes" may almost be called essays, and these, as a rule, deal seriously with serious questions, but they are much too long to reproduce. We shall have to content ourselves with what is more compressed and portable. There is probably truth as well as beauty in the following:—

"There is reason to believe that, instead of the unfathomed caves of the ocean being black with outer darkness, they are ablaze with golden splendour. The creatures brought up from tens of thousands of feet below the surface, are singularly phosphorescent, and it is probable, nay, almost certain, that every movement of every living being in these abysmal depths flashes out brilliancy." The same praise cannot be awarded to the following, which we cannot help regarding as a very grave mistake in regard to man and the world he inhabits.

"The microscope is almost as humbling as the telescope. The microscope shows that the race of man is as paltry in point of number as the telescope shows his habitation—the earth—to be in point of size." Humbling truly to ignorant human vanity, but not to man as an observant and reasoning creature. And certainly not humbling to him who sees only cause for wonder and love in contemplating the works of the Creator in the minutest atom, as in the great scheme of creation so far as man is capable of contemplating it. The following flies slightly wide of the mark.—

"Many a man has been led into Atheism by the very idea of the goodness of God. Not being able to square that idea with the mercies of life, he has thrown up his belief in God altogether. The truth is, it is easier to disbelieve in God than to disbelieve in His goodness." This, perhaps, is not altogether a mistake, as there is no knowing what may be the condition of certain individual minds; but is it not more true that a vast majority of those who are called Atheists are really not so, and have only abandoned a belief in certain attributes and actions which they suppose, perhaps mistakenly, the general run of believers accept as belonging to the Almighty? We frequently give a name to what we cannot explain, but where we can only guess it is as well to guess as charitably as possible. Can this be true? "Live with the cleverest men of the day—artists, statesmen, authors, bishops, judges, generals; during a whole month put down every striking and original remark you hear; if you cover a sheet of foolscap I'll eat my hat." This, of course, must depend in a great measure on the amount of information possessed by the listener. Mr. Buxton, no doubt, met large numbers of the people he refers to, but it is not on record that he ever ate his hat. It may, therefore, be safe to assume that the observation is justified. The following is more curious than profound:—

"I should like to know from young ladies which is the best, to be flirted with and forsaken, or not to be flirted with at all. I suspect the former—they do so dearly like being made much of." Perhaps its true answer may be found in Tennyson—

> "'Tis better to have loved and lost,
> Than never to have loved at all."

Here is something worldly, but useful:—

"That, on a great scale, taking men in millions, good feeding helps both mind and morals is clear. Man is one being. What sets his body right, in the long run, sets his soul right. Beef and beer turn into manliness. There was never a brave, self-reliant, wise people with pinched bellies."

Again—

"Many things help to make a nation rich. Safe harbours, deep rivers, rich soil, fine climate, wise laws, long peace, and so forth; but no one thing fills the bag so fast as truthfulness."

This is not a volume to read through; but it may be frequently taken up during leisure moments, and never without some degree of profit.

The Life and Letters of St. Francis Xavier. By HENRY JAMES COLERIDGE, of the Society of Jesus. Burns and Oates, Portman-square.

THE lives of saints are not, as a rule, pleasant reading; and however they may at one time have suited the contemplative and credulous portion of the world, in the present stirring and critical times we turn from them as too much of a tax on our time and temper. It would be wrong, however, in this matter not to discriminate. One or two saints of the more modern time must be excepted, as they come before us with so much gentleness and good sense, that were they to be considered merely as gentlemen and men of the world, we could not refuse them our admiration for their benevolence, sweetness of temper, and wit. St. Francis de Sales is one of these, a man who assumed nothing, was always true and natural, and who rebuked offences in others by the uniform gentleness and uprightness of his own life rather than by verbal assumptions of holiness. Some of his sayings, as recorded by Camus, Bishop of Belley, constitute maxims of life of the very highest and best kind. "That sincerity which is not charitable," he observes, "proceeds from a charity which is not sincere." Also, "If you must fall into any extreme, let it be on the side of gentleness." Again, "It is far better to be good and simple than shrewd and mischievous." One more: "If an action may be considered in more lights than one, always choose the most favourable." The sturdiest Protestantism we are sure would stand uncovered in the presence of such a kindly Catholic saint as this.

St. Francis Xavier, of whom the present volume treats, was also a man of kindly nature, and full of true Christian gentleness. Born at the opening of the sixteenth century, in Spain, of a good family, he grew up to be a man of high intellectual qualifications, pure mind, and blameless life; he afterwards, with others, joined Loyola in founding the Society of Jesus, and was, during the whole of his life, one of the most active of that famous society. Mr. Coleridge traces his career with a loving hand, but with too much obtrusive admiration, as, apart from his fine natural character, it is difficult to see in him anything beyond the honesty, sincerity, and purity of motive with which he laboured, according to the fashion of the age, to promote the interests of religion, especially by the conversion of the heathen. The manner in which his present biographer speaks of his penances may be edifying to readers of a particular turn of mind, but it is not difficult to imagine what an ordinary English reader would say of the following spiritual exercise. It appears, that when a youth amongst the scholars at Paris, he was vain of his great agility in running and leaping and other exercises, and to punish himself for this sin, he bound cords round his arms and thighs, which he did not remove when he started with his companions on a journey from France into Germany. The pain he underwent was so severe, that at last he sunk under it. When examined, it was found that the "cords had buried themselves deeply in his flesh, which had swollen round them so that they were hardly visible, and the surgeons who were called in despaired of being able to cut them. His companions betook themselves to prayer, and the next morning the cords were found to have broken of themselves, and the swelling had passed away." For some time he and his companions laboured in works of charity. At Vicenza he fell ill, and had a vision of St. Jerome, who told him of the different places he was to labour in, and of the crosses and trials with which he was to be troubled, all of which possibly came to pass just as foretold.

One of the great turning points in his life was his mission to India, and in relation to this we have very full information furnished by his letters. The manner of his conversions are nearly always rather curious.

Amongst the Paranas, a woman in danger of death through childbirth was prayed over and baptised by our saint, and safely delivered, whereupon the whole village was called on to embrace the new religion, but "they said they could not venture to leave the religion of their ancestors without the permission of their master. Then I went to the steward of the chief, who happened to be there to exact some taxes due to his lord." This man "declared that he thought it a good thing to be a Christian," though he was not inclined to be one himself. "However, the chief people of the place, with their whole households, were the first to embrace the faith; the rest followed their example, and so all of every class and every age received baptism." We are told after this of many very extraordinary things, especially of his having preached to as many as thirty different peoples in thirty different languages, speaking to each in that which it understood. The following extract will furnish further information relative to some of the extraordinary labours of our missionary saint:—"The number of his miracles on the fishery coast and in the adjacent parts was so great, we are assured that they would of themselves fill a large volume. Some few of the most signal of these miracles may be rapidly mentioned. A beggar, covered with sores and putrid wounds, asked an alms of him; and Francis washed him with his own hands and drank some of the water, and sent him away perfectly cured and sound. He was about to say mass in a little church at Combutur, when a crowd entered with a corpse of a boy who had been drowned in a well. The mother threw herself at the feet of Francis Xavier, who had baptised her child, and implored him to restore him to life. After a short prayer he took the dead child by the hand, and made it arise. The child rose up at once, and ran to his mother. One of two youths who accompanied him as catechists was bitten at night in the foot by a cobra di capello, was found in the morning to be dead. Francis touched the foot with the saliva from his mouth, made the sign of the cross over him, took him by the hand, and bade him rise in the name of Jesus Christ. He rose at once, and was able to continue on his journey immediately, as if he had been simply asleep. There are more cases related of his raising the dead in this part of the country; and it is even stated in the processes that one of the children whom he used to send about in his name to the sick raised two dead persons to life."

Of course there is much in this volume as to the rules and government of the Jesuits, their objects and proceedings; but the details of the life and labours of St. Francis fill the chief part of it. The miracles we have given are thickly scattered throughout the whole book; and it would appear that the good man believed very honestly in his power to actually perform some of those attributed to him. It may be remarked, however, as very likely that his credulous and superstitious admirers, as was the habit of the time, touched up ordinary facts, until they assumed the appearance of edifying and useful miracles. The following, which is the last we shall refer to, reads very oddly as a manifestation of supernatural power, and in the present day would not count much to the credit of its author. In his journey from Meliapor to Malacca, "a soldier was on board very fond of cards, which were in great request to cheer the tedium of the passage. One day he was very unlucky and lost, first, all his own money, and then a large sum, some hundreds of crowns, which had been committed to his care by a merchant of Meliapore, to be conveyed to a correspondent at Malacca. When all was lost, the poor man broke out into blasphemies against God, and then sank into a deep melancholy, which brought him to the point of throwing himself into the sea. Francis was told of his danger; perhaps, as was so often his wont, he had been looking on at the game, talking with the players and by-standers. He took the man aside, and began to comfort him as well as he could, but it seemed impossible to make him resigned. Then Francis borrowed fifty reals of a friend, and brought them to him with a bright smile on his face, telling him to go and try his luck again. Before the play began, he took the pack of cards in his hands, turned them over once or twice, and then gave them to the players. This time the luck was all on the side of the soldier, who soon won back all that he had lost. He was going on with the game, when Francis forbade him to continue, and taking him aside, spoke to him sweetly and gravely of the risk which he had run of throwing away his soul as well as his life. The man became truly penitent, and never touched cards again."

Whether reading of this kind, even when narrated to illustrate the life of so good a man as St. Francis Xavier, is in any way profitable, we shall leave to our readers to decide, as we shall also leave to them the question as to the intelligence and common sense of those for whose edification this volume was written. Mr. Coleridge, the author of this book, was, we believe, educated as an English Protestant gentleman, but has since gone over to the Church of Rome. His right to have done this is unquestionable, as all honest changes of opinion are justified by the motives by which they are prompted. He is now a member of the Society of Jesus, in ordinary phraseology, a "Jesuit." In this, also, his right cannot admit of question. But without censuring the change mentioned, or its motives, we think we may fairly question the intellectual or moral profit of a proceeding which has fitted an educated and clever man for the production of a work which so strongly evidences qualities of mind utterly at variance with the acquired knowledge and habits of investigation, characteristic of the century in which he lives.

Memoir of a Brother. By THOMAS HUGHES, Author of "Tom Brown's School Days." Macmillan and Co.

IT is needless to say that a work from the pen of the author of "Tom Brown's School Days" has in it many charms apart altogether from the interest of its subject. It would be difficult to describe accurately all that constitutes the special charm of style and thought so characteristic of Mr. Hughes, but when we claim for him earnestness, clearness, manliness, and an unaffected sincerity in regard to what he has to say, and a delightful simplicity and strength of utterance in saying it, we ask no more than is fairly his due. His first and best work, "Tom Brown's School Days," is, perhaps, the best boy's book ever written. In saying this we are not comparing it with such old favorites as "Robinson Crusoe" or "Gulliver's Travels." It has scarcely anything in common with these, and is altogether different in intention and effect. "Robinson Crusoe" was written by a man, for boys, and its interest belongs chiefly to its literalness—its matter-of-fact style, as a vehicle for incidents which are remote, strange, and startling. The boy-mind is most delightfully deceived by the air of truth given to such strange incidents by the circumstantiality and seemingly scrupulous exactness of the writer. But throughout the whole current of the narrative the boy is carried out of himself, and beyond his own experience. And, although there is much good moral teaching by the author, it does not touch the young reader as naturally arising in his own conscience by his own reflections on his own conduct.

In "Tom Brown's School Days" the thing is altogether different. It is a book written by a boy for boys. Its wisdom does not seem unnaturally united with the trusting simplicity of youth. Its thoughtless heartiness when play is on, and the game is the only proper thing to be thought about, is what every man will remember in himself, but which no man but Mr. Hughes has ever been able to describe in the boy's spirit and tone, with a boy's directness and simplicity of spirit, with nothing avoided but those exuberances of feeling and extravagances of manner which make the best boys sometimes rather too much for staid men, in their graver moments.

The present volume, in a certain sense, may also be called a boy's book, inasmuch as it was written for the author's own sons, and for his nephews, the sons of the dear lost brother, with the incidents of whose life it deals, whose memory he, no doubt, desires to have held in reverence by the young people to whom he addresses himself.

The author was born thirteen months after his deceased brother, and from childhood they had been playmates, school-fellows, and college companions. The story of their lives is told with great simplicity, and it is clear from the adventures related, and the snatches of letters given, that George E. Hughes was a fine, frank-hearted, honest, courageous youth, equal to any need required by duty. The way in which Mr. Hughes works out the contrast between himself and his brother George is really very interesting. The following extract we are sure will be relished, not only for the exquisite little story it contains, but also for the reflection by which it is closed:—"My form (at school) had a lesson in the early Greek history to get up, in which a part of the information communicated was, that Cadmus was the first man who 'carried letters from Asia to Greece.' When we came to be examined the master asked us, 'What was Cadmus?' This way of putting it puzzled us all for a moment or two, when suddenly the words 'carried letters' came into my head, and, remembering the man with the leather bag who used to bring my father's papers and letters, and our marbles and whip-cord, from Farringdon, I shouted 'A postman, Sir.' The master looked very angry for a moment, but, seeing my perfect good faith, and that I had jumped up expecting to go to the head of the form, he burst out laughing. Of course all the boys joined in, and when school was over I was christened 'Cadmus.' That I probably should not have minded, but it soon shortened into 'Cad,' at which all the blood in my eight-year-old veins was on fire. The more angry I was, the more some of the boys persecuted me with the hateful name, especially one stupid big fellow, of twelve or so, who ought to have been two forms higher, and revenged himself for his place amongst us little ones by making our small lives as miserable as he could. A day or two after, with two or three small boys for audience, he had got me in a corner of the playground, into which he kept thrusting me violently back, calling me 'Cad,' 'Cad,' while I was ready to fly at his throat and kill him. Suddenly we heard a step tearing down the gravel walk, and George, in his shirt-sleeves, fresh from a game of rounders, rushed into the circle and sent my tyrant staggering back with a blow in the chest, and then faced him with clenched fists, and a blaze in his eye, which I never saw there more than two or three times. I don't think many boys or men would have liked to face him when it was there. At any rate, my persecutor didn't, though he must have been a stone heavier, and much stronger. . . . George went back to his rounders after looking round, and saying 'Just let me hear any of you call my brother "Cad" again. I don't think I ever heard that nickname again at our first school, and it must have been very shortly after this he wrote home, 'I find I like Tom better at school than I do at home, and yet I do not know the reason.'

The strongest and most generous natures are always fondest of those who lean on them."

The account given of the college time, time spent in sports, and in the beginning of a professional career—very soon terminated—all bear evidence of the same kindly generous, strong spirit. But a part of the book which will be interesting and profitable to all fathers as well as sons, is that containing the letters written by the father, John Hughes, to his sons, Tom and George, particularly those to George, whilst at school. In all senses they are manly, as well in their affectionate approvals as in their tempered and wise censures. Every circumstance connected with the life of George Hughes was calculated to beget in him the many fine human qualities he possessed, and in this record of him and his doings, given to us by a loving brother, much will be found useful beyond family limits. The "uprightness and downrightness" of much that it contains will, it is to be hoped, influence many lives yet in England, and assist with other influences in shaping a character for Englishmen, and a future destiny for England, honourable to herself and profitable to the world. We give the following as a specimen of his fun sent as a valentine to his son, at Rugby, in the February of 1872:—

> This is the month when little Cu—
> —pid robs us of our senses, Oh!
> 'Tis he inspires me to renew
> My doleful strains of love to you,
> Oh, charming, fascinating, cru—
> —el Walter Jacky Mansfield Hugh—
> —es, Scholæ Rugbiensis, Oh!
>
> I learn to dance and sew, while you
> Are learning Latin tenses, Oh!
> How I should like to dance with you,
> Instead of with my frightful grow—
> —some governess, Oh, charming cru—
> —el Walter Jacky Mansfield Hugh—
> es, Scholæ Rugbiensis, Oh!
>
> I'm sure the least that you can do
> To calm my nerves and senses, Oh!
> Is (though 'tis slightly overdue)
> To take this little *billet doux*,
> And be the valentine so true
> Of her who signs herself your Su—
> —san, charming, fascinating cru—
> —el Walter Jacky Mansfield Hugh—
> —es, Scholæ Rugbiensis, Oh!
>
> YOUR SUSAN.

The Mormons and the Silver Mines. By JAMES BONWICK. Hodder and Stoughton.

THERE is not much that may be called new in this work, and perhaps the most curious part of it, that wherein the writer deals with special eccentricities of creed, and the people who have originated them, and who constitute their sectaries, will be least liked by the general run of readers. Certainly, Mormonism is not a subject that English people, as a rule, take much pleasure in discussing, and yet, Mormonism, being a very positive, and a very curious fact in life, it is right that intelligent readers should understand it. It is not to be believed that such a system can last, and notwithstanding the prosperity and comfort of its people, it is clear that the differences of opinion already spreading amongst them, encouraged by the influx of strangers brought by the Pacific Railway, will, in a little time, destroy the worst features of this system, and ultimately bring things back so as to assimilate with the ordinary conditions of American society. America is a country where, through lack of labour, inventions of all sorts will be greatly stimulated, new ingenuities in connection with daily work will find daily application. But it is just as natural that new ideas, eccentric thoughts and every possible variety of moral or immoral suggestion should seek to clothe themselves in fact. We have a religious system in England which is constituted of many sprouts from the old root of the Established Church. In America they have no Established Church, and they have the most thorough freedom of opinion. What wonder, therefore, if, where the conditions of life include a fuller personal independence, there should be a more adventurous statement of thought, and a more general disregard of what may be approved of by society generally. Mr. Bonwick looks with much charity on the many moral curiosities he describes. Society has never been able to correct these things by harshness, and frequently, to say nothing of the means adopted, it has sought to subdue the better by the worse. Brigham Young's marriage scheme does not affect us much; and Mrs. Woodhull's extravagances are, perhaps, not much worse than the state of things revealed by our Divorce Court. Much purification in society is needed, and whilst we may very sincerely deplore certain of these American extravagances, our prime duty is to see what we can do for reformation at home. Mr. Bonwick's book, on the whole, is worth reading, not so much for its geology, as for the strange social glimpses it gives us into certain conditions of American life, but it requires to be read with a patient and understanding temper.

Words and Works in a London Parish. Edited by Rev. C. ANDERSON, M.A. Henry S. King and Co., Cornhill, and Paternoster-row.

THIS handsome volume consists of a number of papers on various subjects connected with the religious and moral welfare of the people, which are republished from a local periodical called the "Soho Magazine." They are short and numerous, and for the most part written by Ministers of the Church of England. It may be said, however, in their recommendation, that they are nearly altogether free from that style of thinking and speaking so common amongst seriously disposed people, especially ministers of religion. Indeed, many of the papers are of a very high class, and quite worthy a serious study by those who take an interest in that kind of parish work by which they were called forth. A paper called "A Christian Aspect of Strikes," by Rev. Harry Jones, in which the views of the writer only want the correction of practical experience to render what he has to say thoroughly sound and useful, is worth reading. He sees clearly the right as insisted on and exercised by the small trades of London, but he misses the clearly thought-out policies, and more thoroughly recognised responsibilities understood by the men belonging to the great staple industries of the country, men by whom combination is carried on with scientific exactitude, and who calculate the consequence of every step they propose to take, because they know how necessary it is to study and respect all interests if they would serve their own interest faithfully and well. The paper in this volume to which we feel disposed to call attention is that on "Labourers' Combinations from a Christian Point of View," by J. Llewelyn Davis. It is really an admirable argument in favour of labourers' movements for the purpose of bettering their condition, whilst, at the same time, it points out the difficulties our farm labourers of the present day have to contend with in seeking to enforce their claims by combination. What he says as to the difficulties belonging to unskilled operatives combining applies to them, however, only when labour is superabundant; when the surplus has been carried off by emigration, or by a transference of their labour from one part of the country to another, or from one occupation to another. Union is as easy to agricultural labourers as to any other class of workers; and it is more than likely that the drain now going on to the United States of America, as well as to the British colonies, will soon make under-supply an almost chronic condition of the labour market in our agricultural districts. The subjects in this volume are much varied, and it may be said with truth that it does not contain a single paper which will not well repay attentive perusal.

Old-fashioned Ethics, and Common-sense Metaphysics. By WILLIAM THOMAS THORNTON, author of a "Treatise on Labour." Macmillan and Co.

THIS, as might be expected from the pen of so able a writer as Mr. Thornton, is a very clever book. It is nearly altogether controversial, and flies at very high game, but it would be venturing too far to say that the author always succeeds in his attempts on the strong positions of those against whom he levels his attacks. Utilitarianism is a subject which has been beaten dry, and remains somewhere about where it was when first brought before the notice of the public. No doubt the old ethical form is sometimes superior to the new, as the household treatment of old ladies is sometimes superior to the highly-skilled efforts of the scientific practitioner, but it would be dangerous to push this too far, even in regard to utilitarianism, as in the definition of a new word, and the explanation of its many significations, we get an understanding of the idea it is meant to represent better than if we stuck to the old phrase with its limited meaning. The article on "History's Scientific Pretensions," running as it does into the oldest of all puzzling discussions, "free will and necessity," is ably done, but it is only one more specimen of ten thousand able disquisitions on the same subject; and no more closes the way to further verbal controversy on the subject than the clouds of to-day will shut up the heavens against those of this day next year. To that subject there is verily no end, and the "last man," if he has time to think about it, will be as much puzzled as we now are as to how he should decide in the matter. On David Hume, as a metaphysician, Mr. Thornton is rather severe, but in treating of the doctrine connected with the association of ideas, he does not thoroughly penetrate the subject by recognising the continuous changes which take place from infancy upwards, and which, through new combinations, show changes in thought as curious as those produced by chemical processes. Into the confutation of Professor Huxley's protoplastic theory, we dare not follow Mr. Thornton. He is very deep, and has raised some points that may even present themselves as difficulties to Professor Huxley himself; nor would it be safe to touch on the more dangerous parts of the book where religion and its opponents are discussed. The writer has the calmness of scientific habit, and deals with the men whose opinions he exposes with very commendable quietness of temper; and were it for no other reason than this, and the great clearness of view by which the book is characterised, it is well worth a careful perusal by those whose studies lead them in this direction.

Old and New London. Cassell, Petter, and Galpin: Ludgate-hill, London, E.C., and 196, Broadway, New York.

THIS publication is of a very pleasing and instructive character, but we are compelled, by want of space, to abstain from saying more at present.

The Little Dressmaker. Fashions for Children and Dolls, edited by Mme. MARIE SCHILD. Containing a beautiful Illustration of the Latest Fashions for Children's and Dolls' Clothing, with the Cut Paper Patterns, &c. (February.) London: S. Miller, 37, Tavistock-street, Covent Garden, W.C.; and all Booksellers.

THIS useful and pleasing little publication continues to sustain its character for utility, adding to usefulness some entertaining remarks on subjects that will be well appreciated by mammas and all who are given to babyolatry.

Shelley's Early Life. From Original Sources, &c. By Denis Florence Mac-Carthy. John Camden Hotten, Piccadilly.

It is always interesting to read about Shelley, not simply because like other men of genius his life was out of keeping with the ordinary routine of every-day experience, but rather because he was so young and so gifted,—so kindly and so amiable in his intercourse with men, and, at the same time, so daring and so uncompromising in dealing with their most cherished convictions. His enthusiasm for good, and his belief in the perfectibility of human nature, were beautiful traits in his character, whilst his own personal unhappiness, which never for a moment dimmed this burning faith in him, gave a charm to his short career on earth, and to crown all, his melancholy and premature death, whilst on an errand of friendship, left behind it a sympathy which, though withheld at the moment through prejudice and mistake, becomes stronger daily amongst those who study his life and works in a kindly and appreciative spirit.

Mr. Mac-Carthy's book is very much less interesting in its handling than in its subject. It certainly corrects several of the misstatements of Mr Hogg, but it does this with so much uninteresting minuteness of detail, and with such a tiresome examination of trivial circumstances that we had almost as soon believe Mr Hogg's rather [illegible] misstatements on two or three matters [illegible] and the trouble of wading through wearisome pages of refutation, even when [illegible] out as Mr. MacCarthy, we are [illegible] does work them out.

The [illegible] the attempt [illegible] productions [illegible] pains [illegible] taken, very [illegible] has [illegible] received. Some few [illegible] and poems from the *Oxford Herald* are given, [illegible] supposition that the poems are from [illegible] of Shelley is reasonable enough, though were there no need of additional proof as to their genuineness, they would add nothing to the fame of Shelley as a poet, nor give an atom of additional interest to his works, even [illegible] his most enthusiastic admirers. The "Ode on the Death of Summer," whatever Mr. MacCarthy may think, is certainly not Shelley's. The phrasing is not [illegible] music, and the verse, which is [illegible] containing internal proof [illegible] is about as unlike Shelley as [illegible] can be. Speaking of Zephyr:—

> Before Aurora's car you amble
> High in air
> At noon when Neptune's [illegible] gambol,
> Braid their hair;
> When on the trembling billows riding,
> Or on the smooth sands idly [illegible];
> Or in cool grottoes they lie hiding,
> You sport there

We are quite certain that the "lolling," which is a vulgar phrase, and which is, at the same time, a wretchedly bad rhyme, would not be tolerated by the delicate ear of so refined a writer as Shelley. We could adduce from his writings, were it worth while pages of poetry connected with elemental personifications every one of which would show that in Shelley's mind there was always a spirit of classic beauty, united with almost celestial harmony, which never, for an instant, permitted him to fall into commonplace vulgarity. If we read his "Autumn," a dirge as a contrast after this "Ode on the Death of Summer," we shall see at once how, in the very essence of it, everything differs from the clumsy, incomplete, and muddy imbecility of the "ode."

Really the most important, though not the most interesting, part of this volume is that which deals with Shelley's visit to Ireland in 1812, when he gave utterance to his sympathies with the Irish people. His opinions, as given by Mr. MacCarthy, from the newspapers of the day, were moderately expressed, and, upon the whole, such as at the present moment would attract no attention whatever. But it appears from extracts taken from his letter referring to this matter, that some of his language offended the more sensitive part of the audience, and that hisses were mixed with the applause by which his words were received. Shelley's "Address to the Irish people," and his "proposals for an association, &c., both interesting pamphlets, are given in full, and these, considering the youth of the writer, are remarkable manifestoes, indicating sound practical thought, as well as honest zeal on behalf of the people in whose struggles he took a very decided interest. But it may be seen at a glance that Shelley's ideas utterly disqualified him for working with such men as necessarily came to the front in a struggle where political strifes are embittered by sectarian difference, and where both forms of prejudice operate to produce every variety of offensiveness. Those who feel disposed to interest themselves in such an investigation as that contained in Mr. MacCarthy's book will find in it much with which to be pleased.

YATES' PATENT SAFETY LAMP.

The object of this invention is to construct miners' lamps in such a manner that they cannot be tampered with or opened by the miner without first extinguishing the light, thus preventing all risk of explosions in the mine from an exposure of the naked flame.

To this end the inventor adapts to the body of the lamp a locking bolt, which will prevent the lower part from being unscrewed or detached from the upper part until such bolt is drawn back. This locking bolt is constantly kept pressed forward by means of a particular spring, and is provided with an arm which bears against a shoulder or block on a screwed pin which works the wick carrier up and down; this screwed pin is provided outside the lamp with a milled head, whereby it can be turned.

When the lamp has been trimmed and lighted, the oil reservoir must be screwed into its place in the upper part, the locking bolt will then bear against some ratchet teeth, the upper end of this bolt will run over these special teeth as the lamp is screwed in, but the bolt will effectually prevent the lamp from being unscrewed and taken apart until the bolt has been withdrawn in the manner previously described, but the light will have been meanwhile extinguished before the upper and lower portions of the lamp can be separated, and therefore all danger from any exposure of a naked flame is absolutely impossible.

The improved light is obtained by a strong and powerful lens glass, securely fixed in a metal frame in front, and a silver-plated reflector at the back of the light, thus producing many times the amount of light for the same quantity of oil consumed in the old Davy lamps; and the perfect security by an apparatus which puts out the light accidentally with any attempt of the miner to open his lamp, indeed, the extinguishing device is positively made to operate by that self-same perfidious act.

On the introduction of the Mines Regulation Bill into the House of Commons on the 23rd February 1871, Mr Wardell reminded the house that of the 230,000 miners in Great Britain 1,100 were killed on the average, in a year, and 10,000 injured, and of this last number 5,000 were permanently crippled.

The safety-lamp now in general use, in consequence of the light having to struggle through the close wire-gauze, does little beyond making darkness visible, which is very gloomy and depressing, and, as it undeniably does not give sufficient light to the miner to enable him to do his work properly, he is often tempted (of course at the hazard of an explosion, frequently fatal to life, and always destructive to property) to open his lamp, and thus to expose the naked flame.

Yates' Improved Safety Lamp gives a cheerful light—estimated at twenty times that of the old "Davy," and sufficient for all necessary purposes, and therefore this temptation to expose the light is removed. Colliers are, however, so accustomed to danger that they grow reckless and despise it; and frequently, for the transient indulgence of a smoke of a pipe of tobacco, will run the risk not only of their own lives, but also of those of their fellow workmen, and of damage to their employers' property. All this is now capable of being guarded against and prevented, as the act of withdrawing the unlocking bolt concurrently actuates the extinguishing device in this lamp, and effectually hinders them from getting at the wick so as to expose the naked flame, it also serves as a tell-tale to indicate that the miner has been disobeying regulations by attempting to open his lamp.

Now that reliable mechanically-extinguished lamps can be obtained, it is to be hoped that very stringent rules will be enacted by the Legislature to make it imperative on all mine-owners to adopt them, and that a very severe punishment will be inflicted on all colliers risking their own and other lives, and the mines-owners' property, by exposing naked lights.

Happily, the advantages are offered with the additional inducement of a considerable economy, as these lamps (paradoxical as it may appear) afford many times the light of the old "Davy" with a decreased consumption of oil, equal to a saving of 50 per cent., or one-half—say 1½ gallons of oil per annum, or in money value about 6s. a year, on every Yates' lamp in use; so that the saving in oil in one year would about pay for the outlay incurred in the alteration of each present inefficient "Davy," lamp into this more perfect and improved lamp, thus giving, cost free, to the mining community all the other advantages of Yates' lamp above described—benefits which, it is trusted, they will rightly esteem, and testify their appreciation of, by universally adopting this lamp.

Cost of a Yates' lamp per week:—

Wear and tear, say	1d.
Oil consumed per annum—three gallons at 4s. equal 12s., or 1s. per month	3d.
Cost of light per week	4d.

Or two-thirds of a penny (a half-penny and a fraction a day.)

The cost of candles per diem is about 1d.; or 6d. per week.

The foregoing calculation is especially commended to the notice of members of the Legislature, Government Inspectors, Coroners, also to mine owners, managers' "Butties," "Doggies," and underground bailiffs of collieries in districts where candles (necessarily naked lights) are still permitted to be used in the pits, as it shows that even the poor apology of a petty saving in the working expenses—too frequently a false economy—no longer remains as an excuse, much less a justification, for endangering the valuable lives of the colliers, often the bread-winners for large families, and it is thought that this view of the matter should interest the clergymen and overseers of parishes in which mines are still worked with exposed lights.

Products of an Australian Mine.—We learn (says the *Athenæum*) from the *Wallaroo Times* of December 4th (South Australia), that the proprietors of the Moonta copper-mine have prepared a very remarkable collection of specimens for our next International Exhibition, consisting of purple ore, black oxide of copper, and ruby ore, together with "marvellously beautiful" examples of native copper. The same journal prints a letter from Mr. Andrew Hume, who, it will be remembered, was despatched in search of Leichardt's papers, of which he stated he knew nothing. This letter is dated from Lawson Creek, Newcastle Lake, August 15th, 1872.

ON CYLINDRICAL OR COLUMNAR FOUNDATIONS IN CONCRETE, BRICKWORK AND STONEWORK.

BY MR. JOHN MILROY, ASSOC. INST. C.E.

IN this communication to the Institution of Civil Engineers, a description was given of an attempt which has been made by the author, acting partly in concert with Mr. J W. Butler, Assoc. Inst. C.E., to render concrete, brick and stone, more easily available for cylindrical foundations. After alluding to brick cylinders, which had been in use in India for centuries, and had more than once been suggested for home works, it was remarked that probably the engineers for the trustees of the Clyde navigation had been the first to adopt them in connection with a great and important undertaking. In 1869, the trustees requested Mr. J. F. Bateman, M Inst. C.E., and Mr. J. Deas, M. Inst. C E., to report on the best means for providing a large and progressive extension of quayage, suited to the present and future requirements of the harbour of Glasgow With a view to obtain a greater depth of water than could be had alongside the existing quays, their attention was directed to iron cylinders and subsequently to brick cylinders. The result was that, in 1870, an arrangement was made with the author, in conjunction with the late Mr. Brassey, Assoc. Inst C E, to construct in brick cylinders, to some extent as an experimental work, the Plantation Quay, an extension westward of the wharves on the south side of the Clyde After a brief introductory description of this work, the author confined his remarks to a novel manner of making the brick cylinders, to the mode of sinking them, to the form of the shoe, and to the general arrangements adopted in the execution of the work

The Plantation Quay was founded on a hundred brick cylinders, sunk in a continuous line close together, so as to form a length of 400 yards of quay. The wells were 12 ft in external diameter, and 2 ft. 4 in thick, thus having an internal diameter of 7 ft. 4 in. Their shape was circular, except at the points of contact, where they were formed with tongue and groove, *i.e.*, a square projection fitting into and sliding in a corresponding recess in the adjoining well. From the bottom of a trench, which was cut down nearly to the level of low water, the cylinders were sunk about 36 ft.; but the earth on the river side was removed when the sinking was completed, and dredged to a depth of 20 ft. below low-water level, thus leaving a length of about 14 ft of cylinder beneath the dredged bed of the river. The cylinders were only carried up 2 ft. above low-water mark, a plug of concrete was then lowered to the bottom of each cylinder, to give it a proper bearing, and to protect the rest of the filling from disturbing influences, when the cylinders were refilled with the sand and other materials which had been excavated. On this foundation, suitably prepared, the rest of the quay was built as an ordinary retaining wall.

The shoe originally specified was that common in India a flat annular plate projecting downwards from the plate, with outer and inner iron shells which met, and enclosed a circular wedge-shaped space. As this shoe was expensive, the author devised a shoe consisting of a short length of iron cylinder, about 4 ft. 6 in. deep, surmounted by an annular plate, which was also supported by radial brackets. The annular plate was about 18 in. in breadth; and the bottom courses of brickwork, which were bolted to the plate, were corbelled until the full breadth of the wall was attained. Instead of constructing the cylinders brick by brick, *in situ*, as was the custom in India, the author resolved, with a view to the expeditious execution of the work, to pursue the novel course of making them in rings, in frames placed on a platform near the line of the quay, and then to put them together, *in situ*, after they had been allowed to consolidate. Close to the line of the cylinders, over which was erected a high gauntry, with a steam traveller, a wooded platform was laid with a low gauntry, carrying a steam traveller. On this platform the rings were moulded in frames, which were constructed of wood in four sections bolted together. Annular layers of wood were fixed to the platform, in such a way that their outer edges might keep the frames in place, while their inner edges served as guides in shaping the eye of the rings. When a ring had been built up with bricks and Portland cement and had partially set, the frame was removed, and the ring, which weighed between 9 and 10 tons, was allowed to stand a few days to consolidate thoroughly When the ring had become thoroughly indurated, it could be removed by means of the travellers and a line of rails, either to be fixed in place or to be stored up for future use.

The sinking of a cylinder thus constructed was effected by means of the Milroy Excavator, a description of which had already been read before the institution. The ground through which the cylinders were sunk consisted principally of sand, but the first three cylinders were impeded by old piles and tie-rods; about a dozen cylinders in the centre of the line encountered a bed of rotten sandstone, from 2 to 7 ft thick, and a nest of boulders, which were frequently met with throughout, had to be brought up in sinking the last ten cylinders The whole of the one hundred cylinders were sunk between the months of August, 1870, and January, 1872, but from that period a large deduction should be made for those occasions on which the sinking was wholly or partially suspended

The causes already referred to, and the unavoidable jamming of the cylinders, rendered very heavy weighting necessary. A load of 7 cwt per superficial foot of frictional surface was required, and to provide for this load 900 tons of cast-iron weights were kept on the ground The weights were circular, of the same diameter as the wells, 5 in. thick, and each weighed about 5 tons. A heavy load could thus be piled up in a small space, and at the same time there was no risk of the load tilting the cylinder by unequal distribution, as was often the case when rails or pig iron were used In sinking the last few feet the usual load was sixty-two iron rings, or 310 tons, which with the weight of the shoe and brickwork (120 tons), made 430 tons as the load necessary to overcome friction.

Such was the system pursued by the author in making and sinking the cylinders of the Plantation Quay. The use of frames in the manner described was found to secure straightness and uniformity of size, a reduction of the external friction by a smooth surface, and an avoidance of confusion in the line of the cylinders The chief advantage, however, was in the decided increase in the rate at which such a work as a quay wall could be executed.

In practical construction, concrete differed from brick cylinders only in this, that they must be made in frames or moulds, and that an internal as well as an external frame must be used. In choosing between them, the question was chiefly one of expense When their relative cost was equal, concrete was perhaps to be preferred, as the process of mixing the concrete and filling the frame was so simple, that it could be carried on, under proper surveillance, with unskilled labour. In this connection, mention might be made of the application by Mr. J. W. Butler of Mr. Ransome's artificial stone "apoenite," on the same system as that employed by the author. Having conceived the idea that it was admirably adapted for the construction of cylinders, he made and sank, in 1871, at the Hermitage Wharf, on the Thames, some experimental cylinders with complete success. They were 8 ft. in diameter, and 9 in. thick. The courses or rings were moulded in frames, and were cemented together with the mixture of which they were composed.

From such illustrations, it was evident that by the use of frames or moulds, not only might the old form of brick well be constructed more quickly and satisfactorily, and concrete and other materials be made available for cylindrical foundations, but every variety of form might be produced, suited to every variety of construction and of situation. Without pausing on the different modifications, the author drew attention to a further extension of the system, suggested by the difficulty experienced in sinking loose cylinders in lines or groups. The difficulty was to a great extent overcome. 1st.—By forming combinations of cylinders, incorporated with or moulded into each other, and sinking them together; and, 2ndly.—By so shaping them a number of combinations could, if necessary, be tied into each other in a simple and efficient manner after they were sunk. The most satisfactory way in which a combination might be produced was by incorporating two, three, or more cylinders, so that their contours overlapped each other; and the combinations might be simply interlocked by producing at the points of contact a space or hole, which could be excavated and filled with concrete. Illustrations of such arrangements for the foundations of quay walls were given and explained.

In conclusion, the author directed attention to the advantages which non-metallic cylinders possessed in comparison with iron. The principal one alluded to was that the first expense at present prices was much in their favour with this important difference; an iron cylinder was after all nothing but a skin to which a weight-bearing body or lining must be given, whereas brick and concrete wells were themselves capable of sustaining considerable pressure. In short, iron cylinders, besides being dearer, must, when sunk, receive at least a lining, which it was evident could itself be sunk without the costly addition of the metallic skin.

DEATH OF CAPTAIN MAURY.—We regret to announce the death of the distinguished American hydrographer, Captain Maury, which is reported to have taken place at Lexington, in the State of Virginia. Perhaps the scientific reputation of Captain Maury stands as high as that of any American of the present generation. Certainly, his "Physical Geography of the Sea" may be said to have initiated a new era in hydrographic science, and the "Challenger" expedition may fairly be deemed a direct consequence of his labours.

FOSSIL QUADRUMANA.—Scientific men are interested just now by Professor Marsh's discovery of fossil quadrumana in the eocene deposits of the Rocky Mountains, thus carrying animal life back to a very remote geological epoch. This discovery reminds me of a story current in clerical circles. Professor Huxley had been delivering a lecture at Sion House, and had pointed out that certain geological phenomena, which he explained, involved the existence of the earth for many hundreds of thousands of years Of course, the majority of his reverend hearers were quite willing to give the Professor any number of ciphers he wanted, but there was one divine who still believed that the world was made in six astronomical days of twenty-four hours each, and he being moved to speak, declared that the geological phenomena in question did not at all perplex him. He had not the smallest doubt that after the Creator had finished His work, the devil had deliberately, and with malice aforethought, introduced all these marks and relics of antiquity in order to deceive. He did not say how it was that the devil had been permitted to do this. That would have opened too large a theological question. It is satisfactory to know that the cleric who thus had the courage to avow his convictions received his reward.—*Antiquary.*

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LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY

NOTICES

THURSDAY, March 13th, at Eight o'clock p m., adjourned general meeting on the "Patent Laws"

THURSDAY, March 27th, at Eight o'clock p m. "On the Construction of Steamers for the Channel Passage, and especially the Sedley-Dicey Construction" By A. J. SEDLEY, Esq., Memb Council I. I.

Monthly Notices.

Technical Education—Tribunals of Commerce—the Lord Mayor, the City Companies, H.R.H. the Duke of Edinburgh, and the Committee of London Liverymen—Special Committee of Inventors' Institute on Patent Law Reform—Sleeping Carriages on Railways—Death of Professor Sedgwick—Removal of the Natural History Collection at Kew to South Kensington—Establishment of the Manufacture of Dynamite in Scotland—Utilisation of Slags in Germany—Sulphur in Iceland—Substitute for Coal Gas—Improvements in the Manufacture of Caustic Soda—The Physometer—Production of Metallic Manganese—Discovery of Graptolites.

SIGNS of new life seem exhibited in the world of Science, especially as regards Industrial Science. The movement in behalf of Technical Education is progressing satisfactorily, as is also that in favour of Tribunals of Commerce, which has the advantage of the energetic exertions of our friend, Mr. J. R. Taylor, who read a paper before the Inventors' Institute, on February 13th, on this subject, as connected with patent cases, and we are glad to inform our readers that the Lord Mayor has agreed to call a public meeting in the City for the discussion of this important matter. As regards the utilisation of the City Companies for the promotion of Technical Education, we have to mention that that matter has once again been brought before the public by Mr Campin, Mr G. Saywell, and Dr. Yeats, and has been favourably entertained by the Committee of Liverymen of London. H.R.H. the Duke of Edinburgh, who has just been made a member of the Coachmakers' Company, has expressed his approbation of this movement. We are informed that the special committee appointed by the Inventors' Institute to report on the recommendations of the House of Commons Committee on the Patent Laws, have held several meetings, and will shortly have prepared their report for presentation to the Council of the Institute.

The progress of civilization as regards railway transit is continuing, sleeping carriages are now provided on some of the railway lines.

We have to make the sorrowful announcement of the death of Professor Sedgwick, of Cambridge—a fact of melancholy interest to all geologists and men of science.

It appears that the Government, in answer to a memorial signed by many of our leading botanists, requesting that the collection of dried plants, library, &c., be not removed from Kew to the proposed Natural History Museum at South Kensington, have signified that there is no intention to effect such a removal, although recommended by the First Commissioner of Works; and the Government promises that, if at any future time such a step should be thought desirable, ample opportunity for consideration of the subject by scientific men shall be afforded.

Extensive works for the manufacture of dynamite have been erected near Stevenston, in Scotland, said to be the first established in this country. They are calculated to be able to produce ten tons of this explosive compound per day.

Slags from iron works have often been sought to be utilised; and perhaps the following process (said to be adopted at Osnabruck, in Germany) is likely to prove a practical success. The molten stream from the tap is allowed to flow into water from a suitable height, in the same way as lead is converted into shot in towers. It is used for filling in between railroad sleepers and the manufacture of concrete, and, when containing considerable alumina, is ground and converted into alum.

The immense stores of sulphur that have long been known to exist in Iceland have recently been proposed to be rendered practically available.

Gas, available for use in the place of coal gas, is proposed to be produced by Mr. Ruck by the decomposition of superheated steam, by bringing it in contact with a mixture of coke and iron at a white heat, thus producing hydrogen with a percentage of anhydride; and, upon this being removed by the action of lime, a heating, though almost non-illuminating, gas is obtained which, upon being passed through a petroleum (specific gravity, 0·68 degrees), the hydrocarbons absorbed render it of illuminating power comparable to that of ordinary coal gas.

Dingler's *Polytechnisches Journal* contains an account of improvements in the manufacture of caustic soda, introduced by Herr Helbig.

A new instrument for determining variations in a given volume of confined air, termed a "Physometer," has been devised by Herr P. Harting, and constructed by W. Olland, of Utrecht.

The *Scientific American* describes a process invented by Mr. Hugo Tamm for producing metallic manganese on a large scale. The process is represented to be an economical and ready one, the fluxes employed being ground glass and fluor spar.

Professor A. H. Nicholson, of Toronto, has been making fresh discoveries of graptolites in the shales of the Quebec group of Point Levis, Quebec.

The Inventors' Institute.

At the meeting on Thursday, the 30th of January, the paper read was on "The Bursting of Pipes from the Effects of Frost." By J. A. Calantarients, Esq.

The chair was taken by F. H. Varley, Esq., Member of the Council.

Mr. Calantarients first succinctly referred to the history of the methods of water supply, and then proceeded as follows, occasionally adverting to the various diagrams herein referred to, which were exhibited on the walls of the room:—

It is difficult to classify the different kinds of pipes in the order of their introduction, and almost impossible to assign them dates. As far as I can make out the order seems to be as follows:—Stone or marble, wood, lead, iron, cast and wrought, glazed earthenware and sheet iron, the last of which was introduced in the 18th century.

I cannot help thinking, however, that wooden pipes must have been used first, and long before stone or marble ones were thought of, for the naturally hollow trunks of trees must have been the first to suggest the idea of making pipes, and wood is certainly the easiest to work. Marble tubes are first mentioned, because the works in which they were first used were great undertakings, where durability and strength were of paramount importance.

At the present day many different kinds of pipes are made for the conveyance of water, but those most generally used are iron pipes of large and small diameters, and lead or composition pipes of small diameter. It scarcely falls within the province of my paper to discuss the comparative merits of different kinds of pipes; so far as my object is concerned they are all equally fragile, and my invention is equally applicable to all the varieties of them.

As you are aware, water at the moment of congelation into ice increases about a twelfth of its bulk, and expands so forcibly as to burst the vessel in which it is contained. Indeed, to speak on the authority of Professor Miller, this expansion force is so enormous, that no vessels have been found sufficiently strong to resist it. Water, the most widely diffused, the most important, and withal the most harmless of all substances on earth, seems as if it could not pass into either of its allotropic conditions without making its effects powerfully felt by the external world. In one form, passing through the bowels of the earth, it produces earthquakes and volcanic eruptions, and in a minor degree through the steam engine it does the Herculean labours of the world. In another form, by percolating through the narrowest crevices of the hardest rocks, it bursts and disintegrates them.

Who can calculate the almost incredible amount of mechanical work exerted in the pulverization of the original plutonic rocks of the earth, and their conversion into the state in which we find them? Yet the expansive force of ice has been the chief agent in bringing about this result. I believe it may safely be asserted that this peculiarity of ice has done more for the benefit of the earth, in the way of preparing food for its vegetation, than steam has ever done in any way (of course, I mean with regard to its natural operations).

Beneficial though this property of ice has been, and is, in the general economy of nature, yet in one particular instance, which concerns us most, it proves prejudicial—for it entails an incalculable amount of mischief, by also bursting our pipes and vessels, which the requirements of civilization, indeed those of real comfort, have made necessary that we should have in the very midst of our homes.

What power is there in nature which does not work for, or against us, according to our capability of guiding it? Lightning, for instance, would strike our noblest buildings and shatter the stoutest masts, were it not that by a simple strip of metal we gently lead its terrific force away into the earth, and take advantage of its subtle power to almost annihilate time and space.

Steam again, as generated in a steam engine, would burst its boiler and destroy everybody and everything in its vicinity, were it not that by means of the safety valve we avoid that danger, and yet compel its power to administer to our wants.

We should scorn the idea of making buildings strong enough, or masts stout enough, simply for the sake of resisting the destructive action of lightning; or steam boilers thick enough to resist any amount of tension which steam is capable of exerting; yet this is the actual practice at the present day with regard to our water pipes. We build a house, furnish and decorate it gorgeously, take care that it is dry, warm, and comfortable, and, above all things, that it has every appliance for a due supply of water; but what security have we that these pipes will not burst any night in winter, and deluge the house on which we had expended so much care and money? No one would for a moment maintain that the thickness of the pipes is any security, and any other, we have none. As the lightning conductor to a tall monument, and as the safety valve to a steam engine, so I offer my invention as a rational and simple means of diverting from water-pipes a destructive force.

It is high time, indeed, that such an invention was made; for it is 300 years (all but 10 years) since water pipes began to be laid in houses, and the nuisance of pipe bursting has continued to annoy householders up to the present day. I can find no account whatever of the means resorted to in former times to prevent the bursting of pipes. At the present day, as far as I can gather, they consist simply in contrivances for the prevention of the freezing of the water, such as packing the pipes with straw, flannel, felt, or cases of saw-dust. These would answer only if the temperature did not fall much below freezing point, and especially that the frost did not last long, if the frost lasted any length of time they would be utterly useless, for they are simply palliative means; another method is to turn the water off at the main stop tap and empty the pipes every evening when it is likely to freeze, this, no doubt, would be effectual, for there being no water in the pipes it cannot freeze; but how can we depend upon this precaution being always observed. If it is neglected but for one frosty night, all the trouble previously taken is thrown away, and the pipes will burst notwithstanding. It is well-known that whatever depends upon constant vigilance is sure to miscarry some day or other, to say nothing of the carelessness of servants whose duty it will be to do it; besides, can we always tell when it is going to burst?—it may happen when we least expect it. This is really analogous to entrusting an engine-boiler, without a safety valve or pressure guage, to a man, and asking him to be on the watch, and turn out all the fire from the furnace whenever he thought the boiler was going to burst. We do not want to be always thinking about our water pipes. What we want is a thoroughly reliable self-acting contrivance, which, once applied, may completely free us from all anxiety.

Having shown that it is a great desideratum of the day to have some effectual means of preventing the bursting of pipes, and that no such means have hitherto existed, I will now proceed to describe to you my invention.

In doing this, for the sake of clearness, I shall confine myself to water in its relation to water pipes, as at present used for supplying houses with water. The principle of the invention being thus clearly explained in one instance, its application to other similar purposes would be easily understood.

As I have already mentioned, water in passing from the fluid to the solid condition of ice expands a twelfth of its bulk, as the force exerted during such expansion is practically irresistible. I propose by my invention to oppose to it not a resisting, but a yielding medium, so that it may give way with ease, and make room for the increased volume of the ice, and by so doing completely divert all injurious tension from the pipes.

The invention, then, in its simplest form, is this. I pass through the service pipes of a house a flexible air and water-tight tube; this tube is one-tenth the capacity or area of the water pipe, and is of sufficient strength to resist being compressed by the mere weight or pressure of the water; one or both the ends of this tube are brought out of the water pipe and fixed to it by means of a short piece of metallic pipe, so that the air within the air-tube communicates with the atmosphere.

Having thus a column of air running throughout all the water pipes, and of a volume equal to more than the difference between that of water and ice when a frost comes, the ice, as it forms, gradually compresses the air tube and takes its place—the air tube thus acting as a safety valve completely diverts all tension from the water pipes. As soon as the ice melts, the air tube, by its own resiliency, reassumes its former shape, and is ready to be acted on again and again by repeated frosts for an indefinite number of years without once requiring human interference. This is really my invention in its simplicity, and in this form it is applicable to all localities where there is no great water pressure.

But where there is great water pressure, and it is not convenient to use too strong an air-tube, I use the forms No. 2 and 3. The only peculiarity of these is, that there is an air reservoir attached to the air-tube, and the ends of the air-tube are closed. The purpose of the air-reservoir is to afford a space into which the air from the air-tubes might escape into where they are compressed by ice.

In No. 2 (as in No. 1) an air-tube is adopted, closed at all its other ends, but opening into an air-tight air-reservoir—the resisting power to compression of my air-tube being known. If the pressure of water (as measured by a pressure guage) at the lowest point of the water pipe happens to be greater than the resisting power of the air-tube, air is pumped into the air-tube and reservoir, until there is sufficient tension produced in the air-tube to counterbalance the pressure of water surrounding it at its lowest point, and the air-tube is kept open. When the water in the pipe freezes, it forces the air from the air-tube into the air-reservoir and takes its place. When the ice melts the air, by its own elasticity, (assisted by the resiliancy of the air-tube) returns again to its former position and distends the air-tube, which thus becomes ready to be acted on again.

In No. 3, the service pipe is provided with an air-tube, closed at all its other ends, but opening into the air-reservoir at a given point. The mode of action here is just similar to that in No. 1 and 2, only that in this form I can make use of much weaker tubing, and the water itself is made to produce the required tension in the air-tube by allowing it to flow freely into the bottom of the air-reservoir. The air-reservoir is attached to the water-pipe somewhere about its lowest point. Its size would be determined by the length and capacity of the air-tubing in communication with it, and by the degree of water pressure in the given locality—but a few sizes can be made to apply to all houses—assuming that it is just fitted up, and both the water pipes and the air-tubes, and reservoir are full of air. As soon as the water is turned on it rushes into the air-reservoir as well as into the water-pipes. When the water-pipes are completely full, the water in the air-reservoir

will stand at such a point as that the air above it will have a tension equal to the pressure of the water—but, as the air-tube is in communication with this air, the same tension would be imparted to the air in the air-tube, and this, therefore, will remain open (assisted, also, by its own resiliency of course). The beauty of this arrangement is that it is entirely self-acting; it enables one to dispense with even the trifling amount of trouble involved in pumping the air in, and, above all, that the tension of air in the air-tube is kept always equal to the pressure of water surrounding it at its lowest point, however much this pressure might vary.

In this case the strength of the air-tubing would be entirely determined by the height of the house, without reference to the degree of water pressure. For instance, in a house 60 ft. high, with a water-pressure of 100lbs., or any number of pounds to the square inch, my air-tube need only have sufficient strength safely to resist a tension of 30lbs. to the square inch, equal to the pressure of water 60 ft. high (roughly speaking), for the remaining water pressure of 70lbs to the square inch is met and neutralised by an equal amount of tension in the air-tube, which tension is produced by itself. The air-reservoir will, of course, be placed in a well-protected corner of the house, that it may not freeze; but even if it did, no harm would result, for the piece of air-tube passing through it is metallic, and cannot become compressed and impede the free communication of air. If any part of the water pipe freezes the action would be exactly similar to that in No. 2. In No. 3 the stop tap can have an arrangement by which the continuation of the air-tube might be kept up when a tap intervenes, or when it is desired to connect two different systems of air-tubes together. Here a metallic tube bent twice at right angles, the ends joined to the air-tubes on each side of, and close to, the tap, inserted into the water pipe, and soldered or otherwise secured to it.

For water pipes of large diameter, such as those used for heating churches, schools, and other public buildings, I would use large-sized air-tubes enclosed in the water-pipes without any communication with the atmosphere, or any reservoir; for a large volume of air being already enclosed in them, the air would easily get compressed into a smaller volume by frost, quite sufficient to relieve the pipes of their tension. Indeed, the same thing might safely be done with the small pipes of a house, for all these pipes never freeze throughout, and the air from one part can easily get compressed into the other parts of the air-tube, and so relieve the water pipes. In No. 5 I have shown an arrangement which will be very useful for water-closets and other similar purposes, and can be applied to them quite independently of the general system of water-pipes in a house. The water pipe which conveys the water from the cistern to the pan of the water-closet. The air-tube begins in a bell-shaped expansion at a given point (which may be placed somewhere under the seat), and ending at a little above the water-level of the cistern; the parts of the air-tube outside the water pipe and its rails in the cistern are metallic. A tap supplies the cistern with water, and the air-tube makes a turn round this before ending. The air-tube will, of course, prevent its bursting by frost, and the cistern, being open at the top, can sustain no damage. But, as great inconvenience is caused by the water-closet becoming inactive during a frost, by suitably applying a light, such as a lamp, warm air might be sent through the air-tube, the ice melted, and the water-closet made serviceable in a short time. If desired, the heat may be kept up so long as the frost lasts, which may be done at a nominal cost, and thus a great inconvenience removed.

The same means, with some modification, might be applied to the general system of water pipes in a house, and thus their freezing prevented, or if frozen, the ice melted, and an uninterrupted supply of water kept up during the severest frosts.

In No. 6 I have shown how the explosion of kitchen boilers might be avoided. Here, the air-tubes being of large size, there is no need of a reservoir. Besides, the portions of air-tube in the boiler, and in the water-tank being metallic, would act as such. The parts that do get frozen are portions of flow and return pipes, and as the air-tube passes through them, they cannot burst, but the air-tube vessel is of larger capacity than required for the expansion of ice alone, so that even if all the pipes were frozen there would still be space left throughout the air-tube, and this thoroughfare would be capable of further compression.

Assuming that all the pipes are frozen and a fire is lit, whilst the water in the boiler is getting heated, the air in the air-tube is also getting heated, and as there is a space throughout it, a circulation of warm air would soon become established. If the fire is not too great, the circulation of warm air would soon melt the ice and establish the circulation of water. But if the fire is great, and the water gets heated and expands too rapidly, then it would compress the air-tube further, and make its way through the space thus gained, melt the ice rapidly, and establish the circulation—indeed, those two processes would almost go together, and so make the explosion of kitchen boilers an impossibility. If preferred, the supply pipe alone may be fitted with the air-tube, which would merely answer the same purpose.

Having now described a few applications of my invention, I will briefly enumerate some of the advantages which would result from its adoption.

1. An actual saving of money; for, at a comparatively trifling initial cost, a house can be made perfectly secure against all possibility of its pipes bursting. As every householder probably knows, the bursting of a pipe does not merely mean a plumber's bill, but an amount of damage is often done to the house with its paper, carpets, furniture, and other valuables, that disfigures the house, and entails great expense, and yet, when all repairs are done, there is not the slightest security that the same infliction will not soon be repeated.

2. Saving of a great deal of worry and annoyance in consequence of pipes bursting, which not infrequently takes place in the middle of the night, and produces more discomfort even than the actual expense entailed.

3. The prevention of all possibility of sewage matter finding its way into drinking water. If a ground pipe happens to become leaky by frost, and sewage matter finds its way to it, there is nothing whatever to prevent the contamination after being mixed with drinking water, [illegible] the pressure i[illegible] [illegible] removed though only [illegible]

4. The rendering [illegible] [illegible] able during frost [illegible]

5. The complete [illegible] of kitchen boiler explosions.

6. Saving of water. There [illegible] great deal of water wasted through long-continued leakage and bursting of pipes.

7. Its easy applicability to all the existing houses, churches, schools, &c., without, in the slightest degree, disturbing the arrangements of the house.

8. Possible saving of metal in the manufacture of the water-pipes, for they now need not be made thicker than actually required to stand the pressure of water.

9. The last, and not least, advantage is, that it being entirely self-acting, requiring no constant watching, and no amount of carelessness from servants would affect it.

The reading of this paper being concluded, the Chairman invited discussion upon it, specially requested Mr. WHITEHOUSE, C.E., and to make some remarks upon it, who said it was a subject he did not feel himself in a position to discuss.

Mr. FREDERICK RANSOME, C.E., memb. of Council, said he thought a flexible air tube a good thing for effecting the object proposed by the author of the paper if such a tube could be introduced and maintained in position, but although there might be some difficulties attending the application of this invention, such as the small calibre of many of the supply pipes now used, and the high service arrangements as adopted in many first-class houses, still there was considerable merit in the proposed plan.

Mr. A. J. MURRAY said that whatever objections might have to be dealt with in order to successfully apply this invention, it was perfectly clear that such a system, if it could be practically carried out, would effect a great public benefit.

Mr. PAYNE, as a practical man, considered that in the case of a house 60 or 70 feet high, the pressure of water would be detrimental to the application of the invention, as constant vigilance would have to be exercised to keep the pipe safe; but he presumed the inventor was prepared to meet this difficulty.

Mr. ED. HALL, as an architect, could testify to the exceeding importance of preventing the bursting of water pipes in houses, for the inconvenience and mischief was so great and repulsive that housekeepers would gladly undergo a good deal of trouble, and spend much money, to avoid being subject to them. Although objections had been started to this invention, he had failed to see what part of the contrivance proposed was bad. He assumed that the inventor must have made provision against the action of a column of water in high houses, and the other circumstances which would affect the utility of his invention.

Mr. EDSON and Mr. HARDY made some remarks on the difficulties of applying india-rubber air-tubes, and keeping them distended, notwithstanding the pressure of the column of water contained in the pipes; and Mr. GEO. CLARK remarked that the real question seemed to him to be whether flexible tubes of india-rubber were reliable, for he had great doubts as to their durability when applied as proposed, he gave the author of the paper the credit of exceeding ingenuity, and trusted that notwithstanding anything that had been said that evening he would persevere in his laudable object.

Mr. ED. HALL then mentioned that in the case of Jennings' water-closets india-rubber tubing had been found satisfactory, and he did not see why it should not be found so in this case.

After some remarks by Mr. MACOMBER, Mr CARTTAR, and Mr. YATES, the Chairman summed up by pointing out the *pros* and *cons*, when

Dr. CALANTARIENTS replied by stating that the results of his experiments were favourable to the practicability of his invention, and he felt every confidence that he would be able to make it a practical success. The various points pressed upon his notice that evening were, he admitted, of a most important kind, but he was not afraid of them, and felt that he should be successful in overcoming them. He thanked the meeting for having received him with so much interest and attention.

A vote of thanks having been unanimously accorded to Dr. Calantarients, also a vote of thanks to the Chairman, the meeting separated.

At the meeting on Feb 13, 1873, Mr. C. G. CARTTAR, Memb. of Council in the Chair, Mr. J. R. TAYLOR read a paper on "Tribunals of Commerce as available for Patent Adjudications," in which after soliciting indulgence for any shortcomings that might be found in his paper, from the preparation of which his attention had been much drawn away by the recent fatal illness and death of

Mr. George Dornbusch, a principal supporter of the Tribunals of Commerce movement, and after having made some remarks on the state of that movement, continued:—"Whether the Tribunals of Commerce to be established should embrace Patent Adjudications is a very proper theme for the Inventor's Institute to consider. It has been thought by Mr. Campin and Mr. Latham, two gentlemen whom I now see before me, and they are both competent to judge, not only as barristers, but scientific men, that patent adjudications, and the 'non-legal element' principle, can be embraced in any good Tribunal of Commerce Bill. Whether such a Bill is brought in by the City of London, Mr. Whitwell, the hon. Member for Kendal, on behalf of the associated Chambers of Commerce, or by the Government, as a public Bill, is but of little consequence so long as the principle is preserved. All present will agree with me, whether such a Bill embraces the "patentee's safety valve," cheap and efficient patent adjudication, or any other branch of British jurisprudence, that this great and much-needed reform cannot be much longer deferred, the country being now ripe for its accomplishment (the cry being for "speed," combined with "economy," in all that relates to patent rights, and the general jurisprudence of the country.

As to the delays in suits for the infringement of patent rights, or in the trial for the validity of patents at common law, perhaps but few here have had the opportunity of knowing so much of these evils as myself, having had as many as 1,000 solicitors' accounts on my books, embracing thousands of suits and actions, not only on the infringement of patent right but of copyright, and every other class of business. I have seen the poor inventor, the man of skill and science, who has burnt the midnight oil in order to perfect his invention, so chilled by the cold blasts of poverty and an ungrateful world, that he has sunk into oblivion, whilst the mere man of money has carried off the prize. I have seen this in all the various stages of the law, from the filing of the bill in Chancery to the final appeal to the House of Lords. The tormenting anxiety of mind of the poor litigant in his approach to the avenue of justice no one can fully pourtray, except the man who is compelled to undergo the painful ordeal. I have often felt ashamed, as an Englishman in this free country, to witness such a mockery of justice. I could mention, as I have already said, innumerable cases where poor litigants have been obliged to stay proceedings through lack of means, and of those who dared not venture to approach the gilded tribunal of the House of Lords. So much for law and justice being open to the poorest litigant in this country. I remember one patent case amongst hundreds of other cases, that of "Muntz v. Foster," which was the fruitful parent of many others, wherein the late M.P. for Birmingham, George Frederick Muntz, figured as the plaintiff, he being the patentee of the yellow metal sheathing for the bottom of ships, wherein as many as six counsel were engaged with briefs for each counsel, running from 200 to 250 brief sheets each. You may judge of the magnitude of the interests involved when I tell you that the patentee realised from his patent £1,000 a week. These are the sort of causes on which lawyers thrive, and are enabled to realise large fortunes, and the counsel are enabled to climb up to the lofty eminences which many of them now occupy in the high places of the land. The eminent solicitor has been pre-eminent for his heavy bill of costs, and his eminent counsel for counsels' fees, which have enabled him to get into Parliament, as the first step in the ladder of preferment, he very naturally turns a deaf ear to the cry of the poor litigant. He says "of all my father's children I love myself the best," and is charmed with the music of—"There is nothing like a good patent case, bankruptcy, charity, or lunacy case, in our Courts of Law and Equity." Owing to my having been for above ten years engaged for two of the taxing masters of the High Court of Chancery, where every bill of costs to be taxed passed through my hands, I can speak with certainty, from the very ample opportunities I have had of witnessing the practical working of the system, that nearly the whole or very many of the actions and suits I have had to do with, would, if there had been proper tribunals of commerce established, soon have been brought to a speedy, satisfactory, and economical settlement.

Why, then, should not Tribunals of Commerce be established in this country? Because the interested practitioner says they will never suit the free soil of England. Why not suit England as well as France, Belgium, the provinces of the Rhine, Denmark, and other places abroad? In Denmark out of 10,000 cases in dispute taken before the Reconciler 8,500 were actually reconciled, and 1,500 were sent from the Reconcilers' Court to the Arbitrators' Court, and from this latter court only 500 cases found their way to the Tribunal of Commerce. In this tribunal seven merchant judges sat in judgment; they were men as well versed in trade usages and customs as the Chairman of the Council of the Inventors' Institute, or the most practical men of business to be found in this country. They were men fitted by education in commercial life to judge of those 500 cases, and to give an intelligent and impartial judgment on the question at issue. The majority of these seven judges give their vetoes and reasons, with as much of solemnity and precision as their lordships in appeal cases in the House of Lords, and thus settled their verdict, and it appears that out of the whole of those 10,000 cases in Denmark, only 50 cases on the question of law found their way by appeal to the superior law courts. It should be borne in mind that before an appeal could be allowed the party appealing had to give security for the costs of such appeals, and that one of the chief reasons for so many cases having been reconciled arose from the high-souled motive that "no trader liked to stand before his fellows to be called an autocrat, and to be convicted of being fond of litigation."

Of course, lawyers, and those opposed to the Tribunals of Commerce system, will have something to say against them, but, what do others say in their favour? What says Mr. M. Defries, of Houndsditch, in speaking of those established in France. He writes,—"I am quite of opinion that a Tribunal of Commerce for England would be of immense advantage to the trading community. It saves a vast amount of trouble, anxiety, and above all, expense, which a trader in humble circumstances can ill afford to pay, and which, as you are aware, is incurred in the present state of the law." Also, what does Mr. Corr Vander Maeren say, and he is of some authority, as he was for many years one of the Merchant Judges of the Tribunal of Commerce in Brussels, and gave evidence, in 1858, to the Select Committee of the House of Commons. He says,—"I have retired from the Commercial Bench now for many years, but I shall be happy to give you every information in my power. It has always appeared strange to me that in a great commercial nation like England you should have had no Court of *special* commercial objects; although you have special Courts of Divorce, of Bankruptcy (which *forms a branch* of our Tribunal), for Ecclesiastical matters, &c."

No one knows better than Mr. Campin and Mr. Latham, as barristers, that lawyers, as a body, have a proverbial dislike to anything in the shape of financial accounts, and this is, no doubt, shared in by very many of their brethren on the Bench, not excepting even the Judges of her Majesty's Court of Exchequer. There are those present old enough to remember the colossal financial accounts in the once celebrated case, of "Small v. Attwood," of British Iron Company notoriety, wherein the law costs in the Court of Common Pleas alone amounted to the enormous sum of £58,000. When that celebrated and long-contested cause came on for hearing, in one of its many phases, before the late Lord Lyndhurst, his lordship, in referring to the above bill of costs, very drily and facetiously remarked "There is nothing like leather." But I am afraid this gratuitous attempt at wit would be but a poor sort of consolation to the broken-down and ruined litigants, and that it would be sorry leather to make boots and shoes from for these unfortunates and their helpless families. Will any one venture to say that such an extravagant outlay as £58,000 for law costs would be at all sanctioned or permitted by any scale of costs if Mercantile Judges were called upon to preside over Tribunals, where such matters had to be determined?

Mr. Taylor added some very able explanations of the general position and bearings of the Tribunal of Commerce question, and showed how such tribunals might be advantageously employed to deal with the affairs of persons in a bankrupt condition, which our present Courts of Bankruptcy seemed as powerless to settle satisfactorily as any that had preceded them. As, however, these explanations and remarks, though worthy of earnest attention, do not concern the express object of the paper, the limitations of our space compel us to refrain from reporting them.

After the paper had been read a discussion ensued, in which the Chairman, Mr. F. W. Campin, and Mr. Latham took part; the tenour and effect of their remarks being that the establishment of Tribunals of Commerce and their adaptation to patent adjudications appeared to be very desirable; it being understood that although there might not be any objection to one of the ordinary merchant judges or adjudicators sitting as a patent adjudicator, yet, the majority of the patent adjudicators must be men of practical and technical knowledge from time to time selected from an ample list or rota; and it was agreed that the whole subject should be brought before the Select Committee of the Institute now sitting.

The Chairman having moved, and Mr. Latham having seconded, a vote of thanks to Mr. Taylor for his able and instructive paper, which was passed unanimously and responded to by that gentleman, the meeting separated.

Preserving Meat by Acetate of Soda.—We published, says the *Scientific American*, in Vol. XXVII, page 149, an account of M. Sace's researches upon the antiseptic properties of acetate of soda, and refer to it again for the purpose of recommending, to the manufacturers of vinegar in the South, the substitution of soda ash for lime in absorbing the products of the distillation of wood. The soda ash may cost considerable more than the lime, but the resulting acetate of soda can be employed to great advantage in the preservation of food, and it would be possible to send the cheap beef of the South, after preservation in the acetate, to a market where it would fetch a high price. Another advantage in the employment of soda is that the crude acetate can be easily refined, and from it the pure glacial acetic acid can be made by treatment with sulphuric acid.

Professor Sedgwick's Successor.—Mr. T. M'Kenna Hughes, M.A., of Trinity College, has been elected Woodwardian Professor of Geology at Cambridge, in succession to the venerable Professor Sedgwick. Originally there were nine candidates, but most of them retired before the poll, and the real contest lay between Mr. Hughes and Mr. Bonney, a Senior Fellow of St John's, the numbers at the close being 112 and 105 respectively. The new Professor is a Fellow of the Royal and the Geological Societies.

Proceedings of Societies.

THE INSTITUTION OF CIVIL ENGINEERS.

At the meeting of this society, held 28th January, 1873, T. Hawksley, Esq., President, in the chair, the paper read was on Cylindrical or Columnar Foundations in Concrete, Brickwork, and Stonework, by Mr. John Milroy, Assoc. Inst. C.E. (This paper will be found on another page of this journal.)

The announcement for the next meeting was as follows:—On Tuesday, February 4th, at 8 p.m., 1° Discussion on "Cylindrical Foundations;" 2° "The Relative Advantages of the 5 ft. 6 in. Gauge, and of the Metre Gauge, for the State Railways of India, particularly for those of the Punjab," by Mr. W. T. Thornton, Secretary of the Public Works Department, India Office.

February 4, 1873. T. Hawksley, Esq., President, in the Chair. The paper read was on "The Relative Advantages of the 5 ft. 6 in. Gauge, and of the Metre Gauge, for the State Railways of India, particularly for those of the Punjab," by Mr. W. T. Thornton, Secretary of the Public Works Department, India Office.

In this communication it was stated that, belief in its superior economy being the one solitary reason why the Indian Government had adopted a narrow gauge for its State Railways, the first thing to be determined was whether this economy was real or imaginary.

Now, the programme of the Indian Government contemplated the construction of 10,000 miles of State Railways. By making them, therefore, on the light metre instead of on the light standard gauge, a saving of ten millions sterling would be effected. To add, then, ten millions to their cost for the sake of avoiding the evils, however great, of break of gauge, was plainly out of the question. Speaking generally, if not made on the narrow gauge, they could not be made at all.

To this general rule, however, there might be exceptions. There might be localities for which, owing to particular circumstances, the broad gauge would be far better adapted, and it was extensively and authoritatively declared that one such locality was the Punjab. The arguments to this effect had been urged with acknowledged force and fairness by Mr. Fowler, and it was to him, as making out the strongest case against the Punjab portion of the Government plan, that the author more immediately replied.

The case stood thus: Continuous railway communication from Peshawur to Kurrachee, a distance of 1,092 miles, being the desideratum; two sections, viz., from Lahore to Mooltan, 214 miles, and from Kotree to Kurrachee, 105 miles, or, together, 319 miles, has already been made on the standard gauge; while two from Peshawur to Lahore, 280 miles, and from Mooltan to Kotree, 493 miles, or, together, 773 miles remained to be constructed. Mr. Fowler, in common with all other objectors, admitted there would be a considerable saving by making these two latter sections on the metre gauge. According to his calculations, the amount of the saving would be £680,000, according to those of Mr. Lee Smith it would £900,000, while by the Engineers of the Indian Government it had quite recently been estimated at £780,000. At the rate of £1,000 a mile, arrived at in the manner indicated in the first paragraph of this summary, it would be £770,000. From Mr. Fowler's figures, however, which were adopted as being the least favourable to the Government, Mr. Fowler made two deductions, one of £327,177 for laying a third rail between Lahore and Mooltan, and for relaying on the metre gauge the present broad gauge rails between Kotree and Kurrachee, thereby reducing the saving to £352,823, and a second of £320,700 for the provision of rolling stock for working through traffic on the (future) metre gauge between Mooltan and Lahore, and for an extra supply of rolling stock between Kurrachee and Peshawur in view of military emergencies, thereby leaving of the originally admitted saving of £680,000, no more than £30,000.

The necessity for the first of these deductions the author did not attempt to gainsay; but, against the second, although believing himself to stand alone in this opinion, he strongly protested. Taking first, the section from Mooltan to Lahore either, he said, the existing quantity of broad gauge rolling stock thereon was sufficient for all expected traffic, whether through or local, or it was not. If it was not, then, in case the broad guage had been adopted for the adjoining sections also, it would have been indispensable to provide additional broad gauge rolling stock for the Mooltan-Lahore section; the cost of which addition would certainly have been at least equal to that of the quantity of metre-gauge stock requisite in order to render the total amount of rolling stock, broad and narrow, capable of conveying all the traffic on a mixed gauge. If, on the other hand, the present quantity of broad-gauge rolling stock were sufficient, then, when supplemented by a quantity of metre-gauge rolling stock for use on a mixed gauge, the total of broad gauge stock would obviously be in excess of the quantity required, to the exact extent to which it had been supplemented by narrow gauge stock, and the difference would be available for sale or transfer to the broad gauge lines, the sale proceeds, or appraised value, serving as a complete set-off against the money spent on the narrow gauge stock.

Similarly, for the Lahore-Peshawur section, the cost of providing rolling stock just sufficient for ordinary traffic would be the same whether the guage were broad or narrow, or the difference, if there were any, would be in favour of the metre gauge; so that, whatever necessity there was for providing additional stock for military contingencies, the necessity would be the same for both gauges, the cost also being the same, or, if anything, less for the narrow gauge. It was thus abundantly clear that, in comparing the cost of the proposed mixed gauge with that of the standard gauge for the entire Punjab system, there was no valid reason for augmenting the former with one penny on account of extra rolling stock; and, the addition made on that account by Mr. Fowler being withdrawn, the saving by the adoption of the mixed gauge remained, as virtually admitted by himself, at £352,823.

The author then proceeded to observe that it was a mistake to suppose that the Punjab Railway system would be complete when, even by the filling up of the gap between Kotree and Mooltan, and by an extension from Lahore to Peshawur, a continuous trunk line should have been formed from the last-named town to the Port of Kurrachee, for these works would speedily have to be followed by the construction of a branch of about 180 miles from Sudkur to Dadur at the mouth of the Bolan Pass, and at no very distant period by a junction line of some 200 miles, connecting the Indus Valley Railways with those of Rajpootana. The aggregate length of these prospective lines could scarcely be less than 400 miles, and as the determination of their gauge would obviously depend upon the one selected for those of the Indus Valley, the choice of the metre gauge instead of the standard for the latter would, taking £1,000 a mile as the difference of cost between the two, occasion a saving of £400,000 upon the prospective lines. Of this additional sum, however, only the £180,000 assignable to the Dadur line was here taken into account; but that much being added to the £352,823, with which the narrow gauge had already been shown to be on Mr. Fowler's principles entitled to be credited in respect of the Punjab, would raise the total saving consequent on its adoption in that quarter to £532,823.

To what extent, then, would such large pecuniary advantage be counterbalanced by the evils consequent on break of gauge? Here it was pointed out that those evils would, so far as import traffic was concerned, be only partially obviated by the adoption of a light standard instead of a light metre gauge, because as the only railway that abutted on the Punjab from the East was laid with rails heavier by one-third than those proposed for the Punjab, even by the advocates of the standard gauge, its proportionably heavier engines could not travel on the Punjab rails without destroying them. Not, however, denying that some evils would be attendant on break of gauge, an endeavour was made to determine its amount. The evil was partly mercantile, i.e., affecting the transport of merchandise—for the inconvenience to private passengers in having to change carriages once in the course of a long journey, was not worth speaking of—and partly strategic. As regarded merchandise there were two points, Lahore and Mooltan, at which it might have to be transladen, but, on the authority of official trade statistics, it was asserted that the quantity of goods liken to be transladen at Mooltan would be practically *nil*, and at Lahore not more, at the outside, than 51,052 tons per annum. Wherefore, fourpence per ton being taken as the representative in cash of the commercial ill-effects of break of gauge, it followed that 51,052 fourpences, or £850 a year, or interest at 5 per cent. on a principal of £17,000, represented the utmost commercial harm that could be done by break of gauge between the Punjab and the rest of India.

The strategic evils were these: First, with the Punjab lines and the metre gauge, all troops and military stores arriving at Lahore, *en route* either for places south of Mooltan, or for places in the direction of Peshawur, would have to change carriages at Mooltan or Lahore. Secondly, however grave the emergency, only the bare rolling stock of the Punjab lines themselves would be available for transport upon them: whereas, if those lines were broad gauge, their rolling stock might be supplemented to any extent by draughts upon the 5,000 miles of broad gauge lines eastward of the Indus. These apprehensions were made light of, as the only conceivable contingencies in which the presence of large masses of troops would be required in the Punjab were such as, like, for instance, a Russian invasion, could not fail to cast their shadows before them so long beforehand, as to allow the Indian Government, with the most complete deliberation, not only to mass whatever troops, artillery, and military stores might be deemed necessary at Lahore as a basis of operations, but also to distribute troops fully equipped amongst whatever advanced posts it might think proper to occupy. Thenceforward the broad gauge railways of the main Indian system would never have to bring up troops to be passed on through Lahore without stopping. Their share in the business of the campaign would consist in maintaining at its proper complement the reserve of men and material at Lahore. Or if, in some unforeseen emergency, a regiment ever did arrive by rail at Lahore requiring to be sent forward immediately, the only time lost would be the half-hour or so spent by the men in walking from the broad gauge train to a narrow gauge train, already laden, in anticipation of their arrival, with whatever guns, ammunition, &c., were needed for their full equipment. This occasional half-hour or so would be the only delay (if any) which ever could be caused by break of gauge.

Respecting the restriction of the projected Punjab lines to their own proper rolling stock, and their inability to borrow from the main Indian system, it was, in the first place, to be observed that, even though the Punjab lines were of the standard gauge, it was only

carriages and wagons that they could borrow from heavy broad gauge lines. Heavy-line engines could not be permitted to travel upon their light rails; so that, in order to be able to utilise on emergency the borrowed vehicles, it would be necessary always to maintain on the Punjab lines a duly proportioned number of reserve engines to haul them, the enormous expense of which would be a serious objection to borrowing. Secondly. Even though this difficulty did not exist, and even though all the engines and all the vehicles of the 5,000 miles of broad gauge were capable of being used, and available for use, on the Punjab lines, there would be not the smallest occasion for them there. The rolling stock of the Punjab lines themselves would be equal to all possible demands. The neighbourhood of Peshawur, near the entrance of the Khyber Pass, and the neighbourhood of Dadur, at the mouth of the Bolan Pass, were the only two localities at which an European or Europeanised invader, would have to be encountered. Let him, then, be supposed to make his appearance simultaneously at both places, and, to assume an extreme case, let a host of Beloochees be supposed to be at the same time giving trouble anywhere between Kurrachee and Sukkur. Even then no question of moving by rail complete *corps d'armée* could arise. Unless the very genius of folly had presided over the previous dispositions, the despatch for a few days together of a regiment a day, every alternate day, from Lahore towards Peshawur, and from Lahore to Dadur, and of a regiment northwards of Kurrachee, as often as one arrived at that port by sea, was the utmost requirement to be seriously contemplated. Now, although the provision of rolling stock for the future Punjab lines was intended to be much below that of most existing Indian railways although, while, according Mr. Hawkshaw, the average complement of the latter was about one engine, with vehicles in proportion for every five miles, the Government authorities were of opinion that, for the lesser traffic of the Punjab, one engine and thirty vehicles for every 13 miles might possibly suffice—yet, even with rolling stock at this exceedingly low rate it had been demonstrated by careful and minutely detailed calculations, that in the course of a week 12,000 combatants of all arms, infantry, cavalry, and artillery, fully equipped, and with a month's rations, could easily be moved from Lahore to Roree, or 11,000 from Lahore to Peshawur.

At the monthly ballot the following candidates were balloted for and duly elected:—Messrs. J. Fowler (Stockton), P. H. MacAdam, T. Medcalf, and J. W. Sandeman, as members; and Messrs. J. Baldwin, W. Berrell, Stud. Inst. C.E., H. J. Castle, Jun., G. Coates, T. Cooke, M.A., J. M Dobson, Stud. Inst. C.E., A. G. Fowler, Stud. Inst. C.E., F. W. Cox, C. O. Gibbons, C. B. Goldson, M.A., J. Gordon, H. Gunning, H. Hughes, H. J. Jackson, J. V. Ley, Stud. Inst. C.E., D. H. W. J. N. O'N. Neale, Stud. Inst. C.E., J. W. Peggs, A. F. Phillips, R. J. Quelch, J. Richardson, A. Siemens, Stud. Inst. C.E., J. Steell, and J. H. Waite, as associates. It was announced that the council, acting under the provisions of the bye-laws, had transferred Mr. T. R. Winder from associate to member; and had admitted Messrs. G N. Abernethy, J. S. Beeman, G. W. Beynon, W H. Cobley, C. Henfrey, Jun., T. Patch, R. Pickwell, E. S. Ratcliffe, F. Stileman, B. F. Wardell, and W. Wright, as Students of the Institution. The announcement for the next meeting was as follows:—

"Tuesday, February 11th, at 8 p.m., Discussion on Mr. Thornton's paper on "The Relative Advantages of the Standard Gauge and of the metre Gauge for the State Railways of India."

ROYAL SOCIETY.

At the meeting on January 30, 1873, G. Busk, Esq., V.P., in the chair, a paper was read by Dr. Bastian on the origin of Bacteria, and on their relation to the process of putrefaction; also, a paper by Mr. R. H. M. Bosanquet on Just Intonation in Music, with a description of a new instrument for the easy control of the notes of the systems of tuning other than the equal temperament of twelve divisions with octave. Likewise, a paper, by Mr. J. Phillips, on the composition and origin of the waters of a salt spring in Huel Seton Mine, with a chemical and microscopical examination of certain rocks in its vicinity.

ZOOLOGICAL SOCIETY OF LONDON.

JANUARY 21st, 1873, Professor Newton, F.R.S., V.P., in the chair. Dr. Gunther, F.R.S., exhibited and made remarks on a supposed ancient Egyptian skull. A communication was read from the Rev. John T. Gulick, containing remarks on the classification of the family *Achatinellinæ*; which he regarded as containing ten well-established genera, seven of which were arboreal and three terrestrial in habit Mr. A. H. Garrod, F.Z S., read a paper on the visceral anatomy of the Sumatran Rhinoceros (*Ceratorhinus sumatrensis*) based on a specimen of this species lately living in the Society's Gardens

Mr. A. D. Bartlett gave an account of the birth of a Sumatran Rhinoceros which had taken place on board the *Orchis* at the Victoria Docks on the 7th December, 1872. The mother and an adult male of the animal along with her had been brought from Singapore, but the male had died on the passage. The young one suckled freely and lived for about a fortnight, and was said to have been accidentally killed. A communication was read from Surgeon-Major Francis Day on some new or imperfectly known fishes of India and Burmah. A communication was read from the Rev. O. P. Cambridge on some new genera and species of Araneidea, chiefly from Mr Thwaites' Ceylonese collections. A communication was read from Dr. J. E. Gray containing a description of the skeleton of the New Zealand Right Whale (*Macleayius australiensis*) and of other whales. Dr. Gray concluded with a general list of the known species of the Marine Mammalia of New Zealand. A communication was read from Mr. G. B Sowerby, giving descriptions of several new shells of the genus *Conus*. A communication was read from Dr. J. C. Cox, C M.Z S., containing descriptions of new land shells from Australia and the Solomon Islands.

For the next meeting of the society for scientific business, to be held at the society's house, in Hanover-square, on Tuesday, the 4th of February, 1873, at half-past eight o'clock, p.m., the following communications were announted as to be then made:—

1.—Mr. R. Meldola.—On a certain class of cases of variable protective colouring in insects. (Received 19th November, 1872.)

2.—Professor J. Allman, F R.S —Report on the Hydroida collected during the expeditions of H. M. S. *Porcupine*. (Received 5th December, 1872.)

3. Mr. George Gulliver, F.R.S —Measurements of the Red Blood Corpuscles of Batrachians. (Received 6th December, 1872.)

4.—Dr. Günther, F.R.S.—Notes on some Reptiles and Batrachians obtained by Dr. Adolf Bernhard Meyer in Celebes and the Philippine Islands. (Received 11th December, 1872.

February 4th, 1873, Professor Huxley, F R.S., V.P., in the chair. A letter was read from the Rev. S. J. Whitmee, of Samoa, Corr. Memb., containing an account of some birds which he was intending to transmit for the society's collection. A letter was read from Mr. Henry W. Piers, late Acting Curator of the South African Museum, Capetown, containing remarks on a specimen of the *Chimæra australis*. Mr. E. Blyth exhibited and made remarks on some tiger skins from India, Burmah, and Siberia. A communication was read from Mr. R. Meldola, containing remarks on a certain class of cases of variable protective colouring in insects. A communication was read from Mr. G. Gulliver, F.R.S., containing a series of measurements of the red blood corpuscles of various batrachians. A paper was read by Dr. A. Günther, F.R.S., containing an account of certain species of reptiles and batrachians, obtained by Dr. A. B. Meyer in Celebes and the Philippine Islands. A communication was read from Mr. A. G. Butler, containing a monographic revision of the genera *Zephronia* and *Sphærotherium* of the sub-order Myriopoda, together with descriptions of some new species of these genera. A communication was read from Mr. G. French Angus, C.M.Z.S., containing descriptions of eight species of land and marine shells from various localities. Messrs. P. L. Sclater and Osbert Salvin read the sixth of a series of papers on Peruvian birds, collected by Mr. H. Whitely, C.M.Z.S., in the Andes of Peru. The present communication contained an account of eighty species, collected principally at Cosnipetz, in the province of Cuzco. A communication was read from Mr. H. Whitely, C.M.Z.S., containing notes on the humming birds collected and observed by him in the Andes of Peru. A communication was read from Dr. J E. Gray, F.R.S., on the genus Ocadia, which he considered should be referred to the family Bataguridæ.

VICTORIA INSTITUTE.

A MEETING of this Institute took place at its rooms, 8, Adelphi-terrace, on Monday evening. Several new members were elected, and donations to the library announced; after which, Mr. John Eliot Howard read a paper on "Scientific Facts and Christian Evidence," in which he showed the impossibility of scientific men observing what Professor Huxley and the disciples of Comte described as the "first commandment of science," viz., "Give unqualified assent to no propositions but those the truth of which is so clear and distinct that they cannot be doubted." He instanced this by describing the Atomic theory, so valuable to all scientific men in their researches; the undulatory theory of light, and the theory of an imponderable luminiferous ether; besides others: theories which, were we to subject them to the same criticism accorded by the Comtists and others to religion, it would be impossible to prove. Mr. Howard concluded by saying, "Hitherto I have been describing the various modes of arriving at scientific facts, and the measure of credence accorded thereto, but when I turn to Christian evidence, I am on different ground,—that of testimony, first divine, then human. Everything is made to depend on an authoritative testimony,"—not to be received blindly, but studied and examined, so that it may be thoroughly received and believed in, and its disciples ready to give a reason of their belief. Christian evidence, though in many respects different from scientific fact, rested on logical grounds that were not to be overthrown, which were not even touched by the oppositions of science. A discussion followed, in which many members took part, and the following interesting statement was made by Mr. Howard as showing the swiftness with which the thrill of magnetic influence is communicated. On the 1st September, 1859, Messrs. Carrington and Hodgson were observing the sun, one at Oxford and the other in London. Their scrutiny was directed to certain large spots which at that time marked the sun's face. Suddenly a bright light was seen by each observer to break out on the sun's surface, and travel slowly in appearance, but in reality at the rate of about 7,000 miles in a minute across a part of the solar disk. Now it was found afterwards that the self-registering magnetic instruments at Kew had made at that very instant a strongly-marked jerk. It was learned that at that moment a magnetic storm prevailed at the West Indies, in South America, and in Australia. The signalmen in the telegraph stations at Washington to

Philadelphia received strong electric shocks. The pen of Bain's telegraph was followed by a flame of fire, and in Norway the telegraph machinery was set on fire. At night great auroras were seen in both hemispheres.

THE MICROSCOPICAL SOCIETY.

FEBRUARY 4.—Anniversary Meeting. W. K. Parker, President, in the chair.—The Annual Report congratulated the Fellows upon the continued prosperity of the Society, and detailed its progress during the past year, showing that a number of valuable papers had been read and published; considerable additions had been made to the cabinet and library; twenty new Fellows had been elected, and five had been removed by death. The treasurer's statement of accounts was also presented to the meeting, and showed a satisfactory balance in hand. The president then read an address, descriptive of his own further researches upon cranial development, which during the year had been chiefly confined to the formation of the skull and face of the common pig. Having briefly indicated the methods adopted, and some of the results obtained, he expressed the opinion that what he had already observed led him to conclude that if all existing forms had really been derived from one, the process must have been slow indeed, but that he saw reason to more than half suspect that there must have been throughout an overruling Will, and that the whole was fore-ordained. The Annual Report having been adopted, and some discussion having taken place, the meeting terminated.

THE GEOLOGICAL SOCIETY.

JANUARY 22.—His Grace the Duke of Argyll, K.T., president, in the chair.—Messrs. C. F. Strangways, A. Irving, T. L. Dickinson, W. B. Kenshead, J. M'Murtrie, and J. Dawes, jun., were elected Fellows.—The following communication was read: "On the Glaciation of Ireland," by Mr. J. F. Campbell.

THE GEOGRAPHICAL SOCIETY.

JANUARY 27.—Major-General Sir H. C. Rawlinson, president, in the chair.—The papers read were: "Journey from Bunder Abbas to Meshed, by Seistan," by Sir F. Goldsmid. The object of the author's journey was to carry into effect a settlement of the frontiers of Seistan, with which he had been entrusted. He left Bunder Abbas with his party on the 23rd of December, 1871, travelling in an E.N.E. direction, first to Bam. They crossed the mountain range near Dosari, by the pass traversed by Major Murdoch Smith in 1860, viz., the Deh Bakri (7,800 feet above the sea). Beyond Bam and Azizabad the country was fertile. Near Fahraj the central desert begins. Beyond this, to the west, is another tract of mountainous country, bounding the fertile district of Seistan. The author found the frontiers of Seistan indeterminable; the district, consisting of a small, compact area on the eastern side of the Hamun, which is called Seistan Proper, wholly in the possession of Persia, and a larger straggling region, to the east, partly in the possession of Beloochi chiefs. The Hamun Lake was found dry, except pools of water at the mouths of the rivers, and the party crossed its southern part, where the bed was perfectly dry. Its limits are well marked by belts of reeds. The waters of the Helmund near, and in the Delta, had been led off by irrigation canals. The area of Seistan Proper was estimated at 974 square miles, and the population at 35,000. Majors St. John and Lovett, R.E., the surveyors attached to the party, had superintended the execution of a new wall-map of Persia, which was exhibited, and which gave a new character to the geography of many parts of Persia. The two great central areas of desert (1,500 to 2,000 feet above the sea-level) were clearly shown, and the snowy ranges running in a N.W. and S.E. direction, nearly parallel to the Persian Gulf, well defined. One of these ranges rises to a height of more than 17,000 feet.—"On the Comparative Geography and Ethnology of Seistan," by the President. Seistan, besides being of political importance as a debatable land, was interesting to the historian. The country physically is dependent entirely on the river Helmud; and it is probable the earliest Arian colonists drew off the whole of the water for irrigation, for in the earliest geographical list, that contained in the Vendidad, the country was called, not from the lake, but from the river. None of the sites of the cities and places named in ancient history could be identified with certainty. Seistan formed the most southerly province of the ancient Arian country of Iran.

FEBRUARY 10.—Major-General Sir H. C. Rawlinson, K.C.B., President, occupied the chair. The following Fellows were elected: Dr. F. Hirth, Messrs. R. E. Largo, W. J. Mantle, and J. M. Spence.—The paper was "On Discoveries East of Spitzbergen and Approaches towards the North Pole on the Spitzbergen Meridians," by Mr. C. R. Markham, C.B. The voyage of Barents, in 1596, was recapitulated, and the honour claimed for him of having been the discoverer of Spitzbergen; but it was argued, contrary to the opinion of some writers, that Barents did not proceed up the eastern side of Spitzbergen, but up the western. Hudson was the next to visit these islands, in 1607, and he was followed in the succeeding years by a succession of whaling adventurers, under the auspices of the Muscovy Company. The most successful of these was Thomas Edge, who discovered and named many islands and inlets, of which a map was given in "Purchas' Pilgrims," but which have been unjustly re-named since, on the erroneous supposition that they were new, by Dutch, German, and other voyagers. After a review of all that had been done, down to the Swedish expeditions, and those of English private gentlemen, Birkbeck, Lamont, and Leigh Smith, in recent years, the author concluded that no ship had ever yet passed round the eastern side of the Archipelago, against which the ice pressed all through the summer, whilst the western and northern shores were free between July and September. To the east and north-east of the islands he believed there was another extensive tract of land or group of islands yet remaining to be visited. He quoted Scoresby and others to show that there was no evidence of the existence of land to the north of the islands, and he believed there was no open sea in the height of summer, but that the loosened ice pressed away southward past Spitzbergen, even from the Pole itself, leaving only lanes and small spaces of open water. He maintained that it was not a route to be recommended for a national expedition making scientific investigations towards the Pole; but that Smith Sound, with its long lines of coast tending northwards, giving the safeguard of the land, was the best route.

THE CHEMICAL SOCIETY.

FEBRUARY 6.—Dr. Williamson, V.P., in the chair.—A communication was made by Dr. H. G. Armstrong, "On the Action of Sodium on Aniline."—A paper, "On Anthrapurpurine," by Mr. W. H. Perkin, was read. Anthrapurpurine is a colouring matter which accompanies alizarine in the crude "artificial alizarine," now so largely manufactured and employed in dyeing instead of madder. Like alizarine, it is capable of imparting brilliant and fast colours to cloth mordanted with alumina or iron.—The last communication, "On Isomerism in the Terpene Family of Hydro-carbons," was read by Dr. C. R. A. Wright. In it he gives an account of his experiments with oil of nutmegs and oil of orange-peel.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

TUESDAY, February 4, 1873. Dr. Birch, F.R.S.L., President, in the chair. Two following Papers were then read:—1. On the Coincidence of the History of Ezra with the first part of the History of Nehemiah. By Rev. Daniel Haigh, M.A.—In this paper the learned chronologist endeavoured to show that Xerxes being the Ahasuerus of Esther, and his wife Amestris, the famous Jewish queen, his son Artaxerxes was assumed at a very early age into co-regency with his father in Persia, while in Babylon he did not date by his regnal years till after the death of Xerxes, at which time, he being thirteen years old, there would consequently arise that difference of chronology between the records of the two kingdoms. In the book of Ezra, the Babylonian era was adopted, whilst in that of Nehemiah the Persian computation is used; upon synchronising the passages contained in Ezra vii. 9–11, and viii. 15, 31, and ix. 1, with Nehemiah i. 1, ii. 1, 3, 9, 18, and viii. 1, &c., it would appear, according to Mr. Haigh, that Ezra started first for Jerusalem, and that at Ahava Nehemiah joined him, about Nisan, B.C. 458, and probably visited Jerusalem for the last time in B.C. 409. 2. On an Assyrian Patera, with an Inscription in Hebrew characters. By Rev. J. M. Rodwell, M.A. This Patera, one of the finest discovered, was shown by Mr. Rodwell to have been used for purposes of divination, the text beautifully written in square rabbinical Hebrew characters, having reference to magical prognostics; although of late date, it yet represented a large class of more ancient bowls, to which, and the practices based upon them, there were many references in the Scriptures. Some remarks upon a Passage in the Pœnulus of Plautus. By Rev. J. M. Rodwell, M.A.—In this paper the learned author had succeeded, by a new translit-ration and arrangement of the words in the famous Phœnician soliloquy, to make a perfectly congruous Hebrew passage, which threw some light upon the reason why king Solomon supplied his Phœnician builders with such large supplies of meal and oil in preference to other commodities. In conclusion, certain Phœnician words were translated, and were shown to occur in an Hebraised form in the Old Testament.

ARCHÆOLOGICAL INSTITUTE.

FEBRUARY 7th, Sir S. D. Scott, Bart., V.P., in the chair.—Mr. Fortnum read some notes "On a Roman Key-like Finger-Ring of Gold, and a bi-cephalic Signet of the same Metal," which were illustrated by a series of Roman key-rings in bronze and gold and by two Roman fibulæ of bronze.—Mr. E. A. Freeman gave a discourse upon the "Early Church of Bradford-on-Avon." His attention had been recalled to this subject by some recently printed remarks, from Mr. J. H. Parker, C.B., on the church of St. Mary, Guildford, in which the latter antiquary stated that "in the interval between A.D. 500 to 1,000 it appears to have been the general custom in most parts of the world to live in wooden houses, and to use wood almost entirely for other buildings also." This was said to be owing partly to the deficiency of skilled workmen and to the general belief that the world would come to an end at the year 1,000. Mr. Freeman controverted this position, showing the existence of many examples of structures in stone on the Continent and in England built within the period named. The small early church at Bradford is another example of those structures, and the evidence of William of Malmesbury, who was a competent authority, that it is the work of the eighth century, is, he thought, fully borne out by the existing remains.—Sir Gilbert Scott considered Mr. Freeman had fully proved his case, and wondered how anyone could doubt the existence of many such

early structures. There was no difficulty in deciding between "Norman" and "Pre-Norman" work.

Mr. Dickinson and Mr. Ferrey discussed several points; and Mr. Waller made some remarks on the drapery of the figures in the ornamentation of the church.—Lord Digby sent a bronze brooch lately found in King's County, Ireland. It had a special type of ornamentation and was probably of the ninth century.—The Rev. J. E. Waldy forwarded a sword of one of the De Veres, Earls of Oxford in the time of Charles the First (?).—Mr. Soden Smith brought two early bronze rings of the Roman period which had been found at Silchester, and an antique silver ring, with bronze key attached, having on the bezel a representation of a fisherman and inscription.—The Rev. A. C. Smith sent a Roman dice of bronze, which had lately been found at Wans, in Wiltshire.—The Chairman exhibited a small collection of Roman and other remains, chiefly mediæval, found in the City of London.—The Rev. E. Venables sent a thumb-ring of steel, lined with gold, found in the ruins of the Benedictine Priory of St. Mary Magdalen, Lincoln. The ring was probably of the eighteenth century.—Mr. Spurrell exhibited two flint implements found on the surface at Erith.—Mr. Mathews contributed two bracelets formed of gold coins of the time of Henry the Eighth, Edward the Sixth, and Elizabeth, which had been found in a bag with others, about twenty, hid in the thatch of a cottage at Malpas, Cheshire.

NEW MIXING AND GRINDING APPARATUS FOR INK, &c.

A vessel, the interior of which is made in the form of an inverted truncated cone, forms the outer part of the grinder. The inner part of the grinder is also made in the form of an inverted truncated cone, and fits into the interior of the vessel, space being left between the bottoms of said parts for the ink and paint to pass from the centre of the core to its circumference. Upon the top of the core is attached gearing connected with the driving pulley. A tube extends down through the centre of the core. To the upper end of the tube is attached a vessel in which the ink and paints are mixed. A post of a smaller diameter than the interior of the tube passes through the core. The lower end of the post is secured to the bottom of the vessel, and its upper end projects into the mixer. A valve retains the ink or paint in the vessel until it has been thoroughly mixed. To the upper part of the post is rigidly attached a cross bar or scraper, in such a position as to be close to the bottom of the vessel, so that the ink or paint can be thoroughly mixed before it is allowed to flow down into the grinder. The valve moves up and down upon the post. As the ink or paint passes down through the tube into the space between the bottom of the core and the bottom of the vessel, it is forced, by its own gravity and the centrifugal force engendered by the revolution of the core, to pass up between the outer surface of the revolving core and the inner surface of the stationary vessel, being thoroughly rubbed and ground during its passage. In the upper edge of the vessel is a spout, through which the ground ink or paint is discharged into a receiver.

IMPROVED SMUT MILL.

This invention relates to a new smut machine in which a vertical shaft, having a series of horizontal disks and vertical wings, is caused to revolve within an upright cylinder of perforated material having horizontal inwardly projecting ribs, so that the disks and wings will throw the wheat or other grain outwardly against the cylinder, while the ribs of the latter will again throw it in towards the shaft, thus reciprocating the grain and insuring the desired result.

IMPROVED SAW FILING APPARATUS.

This invention relates to a new grinder machine for sharpening or gumming saws, circular or upright, sharpening moulding bits, or other articles for which emery or grinding wheels are used. The invention consists more particularly in hanging the emery wheel in a jointed frame, which, by virtue of its several joints, is under full and absolute control of the operator, who can therefore set and apply the grinding wheel at any suitable angle to the article to be sharpened.

NEW APPARATUS FOR GRAINING GUNPOWDER.

This invention has for its object to facilitate the reduction of gun and blasting powder into grains of the requisite size and configuration; and consists principally in the use of a series of reciprocating knives, which cut the cakes of powder into pieces and gradually reduce the pieces until the desired degree of fineness has been obtained, all without creating waste in the form of dust to such an extent as the same is being created by the devices now in use. The invention also consists in the combination with said reciprocating cutters of adjustable feed devices for moving the powder to be cut, and of means for cleaning the knives of any powder that may adhere to them.

NEW MACHINE FOR BENDING BARS AND TUBES.

This invention relates to an improved apparatus for straightening or bending metal bars, shafts, tubes, rods, &c.; and it consists in the combination of a hook, screw, and a bearing plate, forming a clamp adapted to control wearing substances on opposite sides of an article to be bent or straightened, and can be used to draw such surfaces nearer together or spread them further apart until the desired effect has been obtained. The invention is applicable to all shafts, &c., while the same are in lathes or hung in bearings in shops, or in any other position whatever.

IMPROVED CAR AND CABLE COUPLING.

This invention relates to a new kind of clamp which is to be attached to railroad cars or other moving devices for connecting them to wire or other cables that are in motion, so that whenever such car or device is by the clamp connected to the cable it will be propelled by the same, while it will remain at rest as soon as disconnected. The invention consists in constructing a clamp of two pivoted jaws which are held apart by an intermediate spring, and can be drawn together against the rope or cable by a cam attachment to a lever that turns on a pin projecting from one of the jaws.

ATTERBURY'S IMPROVEMENTS IN PERMANENT WAY FOR RAILWAYS FOR SEA AND LAND.

We again call the attention of railway contractors and others to this system of lines for railways, whereby cheapness and durability are, it appears, combined as regards material, in such a manner that a line once laid down, in accordance with this invention, would retain its durability for an indefinite length of time, no wooden sleepers of any kind being used, and the line itself constructed upon a peculiar principle, iron rails, bolts, or chairs, as at present used, not being required, and in case of accident to the carriages, it is affirmed, that the line would not be disturbed or torn up as under the present system of railway lines, where the rails are so often getting out of order that it may be considered that about every five years an entirely new line is laid down by the repeated reparation of the old one. For the Severn Railway, Gloucester, each tube of 12 feet in length, weighing 18 tons at £10 per ton, will cost £180. For five miles the cost would be £131,945 in iron alone.

Mr. Atterbury writes to inform us that this can be effected without stopping the Severn or the sea navigation; after the first segment is put down one mile per day can be constructed on his principle. Mr. Atterbury also remarks that a railway from Dover to Calais, that is, 21 miles, could be constructed on his plan, if the work be carried on without delay, by the latter end of July, 1873.

Singular Defect in Australian Gold.—It is said that some 6,000 or 7,000 lbs. of Australian gold, known as 'brittle,' having recently been coined by the French Mint for the Bank of France, all the pieces have been found to admit of being easily broken, and they have, therefore, to be remelted. This is attributed to the presence of a small percentage of antimony and arsenic, extremely difficult of removal; and these elements are known to produce a similar effect in all metals or alloys which are subjected to the molecular changes induced by the pressure and heat developed under the action of the dies in the coming press. A medal, which bears on its obverse the portraits of Dr. Janssen and Mr Lockyer, and on the reverse the chariot of the sun with Phœbus indicating the prominences of an eclipsed sun has been forwarded to the latter gentleman by the French Government, in commemoration of his discovery of the method of observing the sun's chromosphere without an eclipse.

The Oldest Inhabitant.—At Copley House, High-street, Margate, on Thursday, January 30, died Mrs. Frances Dodgeon, in the 95th year of her age, having been born, according to the *Thanet Guardian* of February 11, in October, 1778. She remembered seeing Dr. Samuel Johnson, and the preparations for his funeral, and she possessed a relic of the lexicographer, given by him to her father—a common tin snuff-box, resembling the boxes in which boys used to carry their worms on fishing expeditions some thirty years ago, and perhaps do still. The deceased lady, who seemed not long ago quite likely to live to confute the anti-centenarianists, retaining the use of her faculties, being able to read and write without spectacles, chatty and cheerful almost to the last, was very weakly, and delicate as a child, and was, by medical advice, taken to Margate for the benefit of sea-bathing, which, for some years she continued, as she assured me, all the year through. She could remember Margate when it was scarce one-eighth of its present size; before the new town and much of the old town were built; before the pier, or Jarvis's Landing-place (the old jetty), or the New-road (Marine-terrace) were formed; and when, though comparatively small, Margate was, as described by Brayley, in 1808, "one of the most fashionable and best frequented watering places in the kingdom"; when the only means of getting there from London were the post-chaise, the stage-coach, or the Margate hoy. She could also, of course, remember the exciting times of the first French Revolution, the rise of the Empire, and our war with Napoleon; and she liked to talk about the great events and persons of her earlier days. She was, however (and herein, probably, lay the secret of her longevity), by nature easy-tempered, quiet, unimpressionable, unexcitable, and self-contained, able to do without society, and for many years she lived very much alone, with only a servant in the house, and only occasionally visiting or being visited by a neighbour.—*Antiquary*.

When George the Third was King.—It is not often given to works to outlive a century and a half, but we understand that Messrs. Dean and Son will shortly issue the 159th edition of "Debrett's Peerage, Baronetage, and Knightage."

POGSON'S COMET.

THE discussion about Pogson's Comet is by no means completed. Professor Oppolzer has published another paper on the subject, and is quite convinced that the comet seen by Mr. Pogson moves in the orbit of Biela. Though the times of perihelion passage disagree considerably, and are so far opposed to the theory of the identity of those bodies, the circumstance may, he thinks, be accounted for by the fact that the perturbations acting on Biela's Comet have not been calculated since 1866, when the elements were re-determined by Signor Michez, of Padua, for the appearance which was then expected. But this can hardly account for the whole difficulty; for on this supposition, how is it that the comet was not seen at that return, which was a very favourable one, and when it was most anxiously looked for? At any rate, it is evidently incumbent upon astronomers to carry on the perturbations to the present time; till then, we must suspend our judgment on a matter which is not yet fully understood.

THE A B C SEWAGE PROCESS.—The Native Guano Company, who are working this system, are circulating the following translation of a report of a trial of this manure at the Imperial and Royal Court Gardens of the Emperor of Germany:—"Whilst officially acknowledging the receipt of the manure of the Native Guano Company, Limited, A B C Sewage Process, sent to me in a quantity of six tons, through Mr. Rawson, General Manager, 1, St. Swithin's-lane, London, August 9th, 1871, I have the honour to report, with reference to the results of the comparative experiments which I made with regard to that manure, in the year 1872, that on account of its nutritive constituents, it may be regarded as an excellent regulator of nitrogenous nourishment. Although the easily soluble vegetable nutritious matters of the Native Guano render it peculiarly adapted, as a standard manure, for all fields and all fruits, it would appear that its efficacy, in regard of increasing the crops, is more certain in respect of light soils, but with a proportionably smaller supply than in respect of heavy soils, as the latter require for thorough manuring 10 to 14 cwt. per acre ("*Morgen*"). The Native Guano requires, for its full efficacy, the employment in the first year, consequently in spring, of frequent atmospheric precipitations, as its quicker yield would appear guaranteed by an increased production of leaves, roots, tubers, and grain crops. Although, in general, the year 1872 was characterized by prolonged drought, it was nevertheless certain that the experiments made by me in Sans Souci, Charlottenhof, the model garden of the Royal Horticultural Teaching Institute, and in the Royal Botanical (Nursery) Establishment, produced very important results. 1st. The yield of such products as potatoes, cabbage, turnips, carrots, and beans was, with a supply of 14 cwt. per acre, a higher one than that obtained on similar soil with stable manure; the potatoes more especially were all compact, large, smooth, and sound. 2nd. For the purpose of producing good grass plots, a top dressing of 12 cwt. per acre in the spring led to excellent results. 3rd. For forced fruit, particularly pine-apples, strawberries, cherries, plums, and grapes, an addition of fifteen parts Native Guano yielded very remarkable results. Judging by these practical results, in respect of cultivation, it will be seen how important is the Company's undertaking, an undertaking which, when carried out to practical use, is, in fact, a question of money for every gardener and agriculturist, and for those reasons I warmly recommend it to the attention of all cultivators of the soil, for the promotion of planting, &c. Sans Souci, the 4th of December, 1872. (Signed) JUHLKE, Director of the Court Gardens of His Imperial and Royal Majesty."

Correspondence.

THE CHANNEL PASSAGE, AND MR. BESSEMER'S STEAMER.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—The article in the last number of your journal on Mr. Bessemer's Steamer does not inspire us with confidence that the Channel Passage will be much improved by that steamer when afloat. Nor do the projectors of the design seem to have confidence that the sailing qualities of the vessel will make the passage all that is required. When the drawings and models of the swinging cabin were first shown to me by a person at Landport, I pointed out to him the certainty that the pitching and vertical motions of a vessel, fitted with the cabin, would not be in any way prevented. Further, I believed and will believe, for I see no reason to doubt, that when the vessel is swayed to either side by an impinging wave, and the saloon perfectly level, the very circumstance of the saloon being level whilst the hull is inclined, will so alter the centre of gravity, and subsequent righting of the vessel, that the rolling will be continued. But, whatever the capabilities of the vessel may be, she cannot possibly fulfil the requirements of the Channel passage. The requirements that science is asked to provide for that passage are safe, speedy, and uninterrupted transit from coast to coast at any time, in any weather, without the possibility of sea-sickness. No vessel can supply all these. Yet, it is perfectly within the power of engineering science to guarantee them all in the Channel passage. It would be a disgrace to that science if she could not do it. But she cannot, of course, do it unless aided by that combination of capital with invention, without which no important act of science can be properly carried out. That science *can* run a railway train from Bristol to Cardiff, and thus bring Pembroke Dockyard within easy proximity to Portsmouth, London, and Woolwich, is perfectly certain. If from Bristol to Cardiff, then, it is equally clear she can do the same from Dover, Folkstone, or Dungeness, to Calais. Those who know how it should be done will not look upon it as a work of surpassing magnitude to cross to either place. But, though not a work of unapproachable magnitude, it would still be a work of surpassing good, and a patent obtained of profit to those who did it.—I am, Sir, your obedient servant

W. HEMPSON DENHAM.

Southsea, Portsmouth, Feb 17, 1873.

HENRY CLAYTON, SON, AND HOWLETT'S IMPROVED MACHINERY FOR MOULDING CONDENSED PEAT.—A public test of this important invention, which we have already commended to public attention, took place at the Atlas Works, Woodfield-road, Harrow-road, London, W., on Tuesday, the 4th ult., and we understand that the results were of a most satisfactory character.

A NEW PLANET.—Sir G. B. Airy, the Astronomer Royal, has forwarded to the public press a copy of the following telegram, which has been received from Mr. Jos. Henry, Secretary of the Smithsonian Institution, Washington:—"February 18, Planet by Peters, 10 min. 0 sec., north 13 min. 40 sec., motion rapid north, eleventh magnitude."

APPLICATIONS FOR PATENTS.

[CONTINUED FROM PAGE 2.

to chandelier and general fittings, the means of illumination being otherwise than that of gas.—H. B. Fox. Waterproof garments.—J. T. Grinsted. Floating wrecks and submerged vessels being sailing or steam ships, and other sunken bodies, and apparatus employed therefor.—G. Gall. Steam boiler and other furnaces.—J. McDougall. Manufacture of manures.—T. S. Morris, and G. Skinner. Castor for furniture, also applicable to other purposes.—C. Pattifer.—Apparatus for producing a blast or forcing air, and which apparatus is applicable to the ventilation of mines, buildings, drains, ships, and other purposes.—W. R. Lake. Machinery for separating the dust, bran, and germs from the granulated portions of wheat (com.)—A. M. Clark. Device for ticketing shop goods, and for other purposes (com.)

On February 3rd.—398 to 408.—H. C. Marval. Rifling barrels for breech-loading fire-arms (com.)—J. Bowden. Manufacture of salt.—J. H. Weber and J. Roy. Umbrellas and parasols.—J. B. Caton. Apparatus for the use of smokers.—J. Thornelos. Organs and harmoniums.—W. E. Gedge. Converting a slow alternate circular motion into a rapid continuous circular motion (com.)—J. C. Andrews. Apparatus for heating water or other liquids by the direct action of steam.—J. H. Johnson. Treatment of essential oils with a view to their employment as fuel for heating purposes (com.)—J. H. Johnson. Manufacture of tin foil and in the covering of other metals with tin, also in the machinery or apparatus employed therein (com.)—F. A. H. Donath and C. E. F. Jasper. Manufacture of cigars and machinery and apparatus therefor.—W. Cook. Suspended and other wheels, and elastic tires for the same.

On February 4th.—409 to 418.—J. C. Mewburn. Cocks for water meters and other like purposes (com.)—J. C. Mewburn. Means or apparatus for lubricating vertical spindles or shafts in spinning or other machines (com.)—J. S. Derham. Kilns for drying and burning bricks, tiles, pottery, and other articles or material (com.)—H. Simon. Tubular boilers and heating tubes (com.)—H. C. Marval. Relating to transformation and manufacture of rifled breech-loading fire-arms (com.)—C. McK. Talcott. Machinery for manufacturing screws (com.)—J. Wilkinson and J. Brook. Manufacture of carpeting and other similar fabrics.—G. Hambruch. Construction of railway carriages.—J. W. Hadwen. Means or apparatus to be employed for mordanting, dyeing, or printing wool, cotton, silk, or other fibres or yarn, or fabrics manufactured therefrom.—R. Chambers. Machinery or apparatus for cleaning wheat and other grain.

On February 5th.—419 to 435.—J. Holding and W. R. Harris. Shuttle tips.—T. W. Dunn, and O. Prangley. Extracting animal grease and other impurities from wool.—W. L. Baker. Improvements in the mode of supplying fires with fuel, and apparatus therefor.—A. Kux. Steam generators.—M. Mirfield, and J. Scott. Fibre-combining machinery.—P. McIntyre. Machinery or mechanism for sharpening masons' and engineers' cutting tools or chisels.—B. Hunt. System of kiln or furnace for the utilisation of the waste heat produced by the burning of bricks (com.)—G. Brown. Permanent shoe for horses and other animals.—W. T. H. Carrington. Apparatus for preventing the slipping of boxes or carriages used in wire-rope transport.—J. P. Barnard. Apparatus for preventing the falling of cages, skips, or appliances in the shafts or uptakes of pits, warehouses, and other places.—J. P. Sharp. Manufacture of steel and case hardening of partially converting iron into steel.—J. Taylor, S. Buckley, and T. H. Chadwick. Improvements in machinery or apparatus for drawing and charging retorts used in the manufacture of illuminating gas.—R. J. B. Mills. Apparatus connected with screw propellers for ships and other vessels (com.)—J. Early. Mode of enumerating passengers in tramway and other cars.—A. M. Clark. Machinery for applying lining to straw board and other substances (com.)—E. R. Chapman. Tuck creaser, quilter, or marker.—C. W. Harrison. Treatment and use of air for the manufacture of gas for lighting and heating purposes, and the apparatus employed therein.

On February 6th.—436 to 445.—K. W. Hedges. Combined steam boilers and steam engines.—J. J. Hays and W. B. Hays. Centrifugal hydro extracting apparatus.—Ann Knevett.—Apparatus to be used in connection with domestic fire-grates.—R. Bamber. Fire-places for economising fuel.—J. Joseph. Attachable and detachable dress, flower, or bouquet holders, to be worn as brooches or other personal ornaments.—W. R. Lake. Electrical brakes for railway trains (com.)—W. Dean and R. Lancaster. Gas regulators.—J. H. Johnson. Combined pencil eraser (com.)—A. V. Newton. Treadle motions (com.)—S. J. Mackie. Explosive compounds and apparatus used in their manufacture.

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THE

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AND RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,

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Full information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur street, Charing Cross.

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APRIL 1, 1873.

EDUCATIONAL ENDOWMENTS.

EDUCATION has at last become a prime question, alike for politicians, religionists, and anti-religionists. Ignorance is to be driven out of the land, and the "three R.'s," together with more or less of the "graphics" and "ologies," are to be firmly fixed in the brains of every Briton.

Zeal for Public Education does not, however, cease when provision has been made for Elementary Education, it is equally alive in regard to advanced education, so much so that we have just witnessed the resignation of a Ministry, occasioned by its failing to produce such a scheme of reformed University education for Ireland as would prove acceptable, not only to the people of Ireland, but also to the people of England and Scotland—a problem, considering all things, easy to propound but very hard to solve. But the subject of Irish education is not the only vexed question, educationally, that our Government has to face, seeing that our Legislature not very long ago recognized the fact that it was necessary to make arrangements in regard to that branch of advanced education which is sometimes termed secondary, for the progress whereof many of our ancestors felt so much concerned that they bequeathed much property for its practical development, as evidenced to all the world by such glorious institutions as Eton, Winchester, Westminster, Harrow, Christ's Hospital, and many others. To place such schools on a footing accordant with the present times, the Endowed Schools Commission was established, and there is no doubt it has hitherto operated zealously, if not wisely. It has without question succeeded in turning inside out many a time-honoured institution, some of them, if the truth be told, sorely needing reformation. However, like other results of modern thought, the action of this Commission has been restricted to looking sharp after the pence—the small things—and leaving the pounds—the large things—to take care of themselves. Eton, Winchester, Westminster, and other institutions, where our aristocracy and wealthy classes have, with unblushing effrontery, appropriated to themselves the patrimony of the poor, have been either left untouched or dealt with so tenderly as to be still practically in much the same position as in by-gone times. The schemes of amendment have had reference only to such institutions as have more or less been fulfilling the intentions of their founders. Perhaps the most notable instance of the kind of action adopted by the Commission is the case of the Emmanuel Hospital in the City of Westminster; an institution regarding only the school branch of it—for it also embraces provision for needy aged persons by means of almshouses—which has from an ancient date been carried on under the governance of the Lord Mayor and Aldermen of the City of London, no one complaining that the education imparted had not kept pace with the times, or that the children admitted into the schools were sons of affluent persons; nevertheless, the Commission must needs decide upon ousting the Aldermen from their position, and then proceed to lay down rules as to the admission of children into the school which are some of them based on mere idealities and others are vicious in principle.

Amongst others is their plan of affording a semi-charity education to those who can pay for it, copying the abominable system of robbing the poor, which is practised at Eton, Winchester, Harrow, and other large public schools, by applying the revenues of the institution to the enhancement of the educational advantages of those persons who are quite capable of obtaining these advantages for themselves at their own cost. We are not quite sure that the Lord Mayor and Aldermen have quite understood the real question they have to deal with in administering this trust of Emmanuel Hospital School. Lord and Lady Dacre, who founded the school, appear to have laid it down as the base of the institution that the pupils thereof should be trained up in such a way as to be fit to exercise efficiently arts and industry, and this, if it means anything at all as applicable to the wants of the present day, means that the education imparted should partake more of the technological than of the literary character. It may also be a question whether there is not a great deal to be said in favour of what the Commission has proposed as to the scholars of the Public Elementary Schools who have passed good examinations, and whose parents are needy, enjoying the benefits of the school, which includes board and maintenance, rather than children selected merely because their parents are poor, for on that, as the sole ground of selection, we cannot see why one poor person's child is to go into the school and another is to remain outside. It may also be desirable that the local authorities in the City of Westminster should have some voice in the nominations to the benefits of the institution, though on this point it ought to be held in remembrance that the Aldermanic body is a part of the guild system which expands beyond the City district; but be all these things as they may, we know enough of the Aldermanic body of London to know that these points would only require to be brought before it to be fully and fairly dealt with. It is by no means necessary to oust the jurisdiction of that body in order to obtain what may be desirable.

Moreover, keeping in view the fact that the founders of the institution evidently intended to provide such an education as should fit its pupils for practising the arts and trades of civilised life, which in these days should partake of the technological rather than the literary character, the Lord Mayor and Aldermen of London, as being men of commerce and trade, would seem to be as proper guardians as could well be selected; and one cannot help thinking this was the view the pious founders entertained in appointing them to that office, as otherwise the Dean and Chapter at Westminster would from their well-acknowledged learning have been likely to be selected.

With regard to Christ's Hospital, or the Blue-coat School as it is sometimes called, there is even a stronger case against the interference of the commission than in that of the Emmanuel Hospital. It is true that King Edward VI. appropriated part of the property of certain suppressed religious institutions to found and endow that school for necessitous children of *Freemen of London*, who might possibly require such assistance; but this endowment forms but a small part of the funds of the institution, and independently of other endowments the establishment is supported by sums of money paid by former and present life governors, who are never a small body, and are men of the highest character and position; consequently, not to speak of their money interest in the matter, are far more capable of administering the affairs of the institution than a few bureaucrats who may perchance have been placed in office by political or Court influence.

There is much useful work for the Endowed Schools Commission to do in guiding public gratuitous secondary education into a right channel, so that the poor man's child, who shows capacity for higher education, shall have his chance of obtaining such education, even when it is necessary to feed and clothe him in order to do this; but it will fail to accomplish it by inaugurating a new half-pay system in lieu of gratuitous instruction, or by upsetting the constitution of managing bodies that are as good as could possibly be selected.

Reviews.

The Theory of Strains in Girders and Similar Structures, with Observations on the Application of Theory to Practice, and Tables of the Strength and other Properties of Materials. By BINDON B. STONEY, M.A., Member of the Institute of Civil Engineers, and Engineer to the Dublin Port and Docks Board. With numerous illustrations, engraved on wood, by Oldham. New edition, enlarged and revised. London: Longmans, Green, and Co. 1873.

WE are glad to find that a new edition of this truly practical, yet thoroughly scientific, work has been called for. Seldom have we to deal with a work so complete as regards the statements of practical details, and so perspicuous in developing the scientific principles involved herein.

The importance of the subject treated of cannot be over-rated, for, as Mr. Stoney aptly remarks:—

"A thorough acquaintance with the theory of strains and the strength and other properties of materials forms the basis of all sound engineering practice, and when this is wanting, even natural constructive talent of a high order is frequently at fault, and the result is either excess and consequent waste of material, or, what is still more disastrous, weakness in parts where strength is essential. The time has gone by when practical sagacity formed the sole qualification for high engineering success. Before the improvement of the steam engine gave rise to a new profession there were, indeed, some memorable names on the roll of engineers, generally self-taught mechanics, whom great natural ability had raised to pre-eminence in their profession; but practice which was formerly excusable, or even worthy of the highest commendation, would, now that knowledge has increased, be properly described as culpable waste, arising either from prejudice or ignorance."

The work now contains explanatory remarks as to strain, tension, compression, transverse strain, shearing strain, and torsion. Perhaps, however, the following statements as to expansion and contraction are the most interesting part of the work.

ARCHES, CAMBER, SUSPENSION BRIDGES DEFLECT, AND GIRDERS ELONGATE, FROM ELEVATION OF TEMPERATURE. EXPANSION ROLLERS. Changes of temperature affect bridges very differently according to their mode of construction. An increase of temperature causes the crowns of iron arches which are confined between fixed abutments to rise, and the spandrils to extend lengthways, chiefly along their upper flange or horizontal member; hence, room for longitudinal expansion should be provided by leaving a vertical space between the ends of the spandrils and the masonry of the abutments above springing level. When iron arches extend over several spans, the spandrils of the different spans should not be rigidly connected together like continuous girders, for then their expansion may cause a dangerous crushing strain along the vertical line of junction and throughout the horizontal member, a portion of which strain will, no doubt, be transmitted to the ribs themselves. When, therefore, it is considered desirable to connect together the spandrils of consecutive iron arches, this should be effected by sliding covers, or some similar contrivance, which, though they restrain lateral motion, yet will allow perfect freedom for changes of length. The rise in the crown of one of the cast-iron arches of Southwark Bridge was observed by Mr. Rennie to be about 1·25 for a change of temperature of 50 deg. F.; the length of the chord of the extrados is 246 ft., and its ... is 23 ft. 1 in.; accordingly, the ... he arch, which is segmental, is ... The cast-iron bridge of Charenton, whose span and versed sine are 35 and 4 metres respectively, has been observed to rise 14 millimetres (·55 in.) on the side exposed to the west from an elevation of 14 deg. C. in the temperature of the air.

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Stone arches are affected in a similar way to iron arches. With increased temperature the crown rises and joints in the parapets open over the crown, while others over the springing close up. The reverse takes place in cold weather, the crown descends, joints over the springing open, and those over the crown close. When stone or iron arches are of large span these movements, from changes of temperature, will generally dislocate to a certain degree the flagging and pavement of the roadway above. This is very conspicuous in Southwark Bridge.

An increase of temperature causes suspension bridges to deflect, just the reverse of what happens with arches. Girders, which exert only a vertical pressure on the points of support, extend longitudinally under the same influence, and on this account it is usual in long bridges to provide expansion rollers, or, if the span be moderate, sliding metallic surfaces, under one end of each main girder. It may be questioned, however, whether sliding surfaces remain long in working order, and some engineers prefer timber wall-plates beneath the ends of the girder, even when the span reaches 150 ft. In place of being supported by rollers, which are apt to set fast, girders are sometimes hung from suspension links, the pendulous motion of the links affording the requisite longitudinal movement due to change of temperature. The chains of suspension bridges are generally attached to saddles which rest on rollers on top of the towers; the object of these, however, is rather to compensate for unequal loading than for changes of temperature.

The working load is a point that has received much attention from Mr. Stoney, as evinced in the following passage:—

WORKING STRAIN OF CAST-IRON GIRDERS. RULE OF BOARD OF TRADE. WORKING STRAIN OF CAST-IRON ARCHES. FRENCH RULE. PROVING CAST-IRON. The reader will observe that the Commissioners considered one sixth of the breaking strain hardly a sufficient limit of safety for cast-iron girders when liable to percussion and deflection from moving loads. This inference was, no doubt, influenced by their experiments on bars which were much lighter in proportion to their trial loads than ordinary bridge girders are compared with the loads which traverse them. As a general rule, *one-sixth* of the breaking strain may be taken as the safe working strain for cast-iron girders which are liable to vibration, as in railway or public bridges, but when the load is stationary and free from all vibration, such as water tanks, *one-fourth* of the breaking strain is safe. When, however, cast-iron girders are liable to sudden severe shocks, as in crane posts or machinery, their working strain should not exceed *one-eighth* of their breaking strain. The railway department of the Board of Trade has laid down the following rule for the guidance of engineers in the construction of railways: "In a cast-iron bridge the breaking weight of the girders should be not less than three times the permanent load due to the weight of the superstructure, added to six times the greatest moving load that can be brought upon it." Notwithstanding this rule, engineers will do well not to design cast-iron girders for railway bridges of less strength than six times the total maximum load, that is, six times the permanent load added to six times the greatest moving load. The reader who desires detailed information respecting the practice of our most eminent engineers during the reign of cast-iron is referred to the evidence attached to the "Report of the Commissioners appointed to inquire into the application of iron to railway structures" in 1849. It seems certain that the transverse strength of thick rectangular cast-iron bars is less than that of thin ones (132), but it does not necessarily follow that the strength of large flanged girders is diminished by the massiveness of the casting or that they are relatively weaker than smaller girders of similar section, for the quality of the iron will, no doubt, materially influence their strength (348, 349). Experiments on a large scale can only decide these questions, which, however, have less importance now than when the Iron Commission sat in 1849, as it is very unlikely that large cast-iron girders will be employed in important works when wrought-iron is available.

Cast-iron can be readily got, on specification, to stand from 7½ to 9 tons per square inch in tension: consequently, the rule of one-sixth allows an inch-strain of from 1¼ to 1½ tons for the usual safe tensile working-strain in the lower flanges of cast-iron girders, but this material is quite unfitted for tie-bars for the reasons referred to in 350 and 351. Cast-iron will safely bear 6 or 7 tons per square inch in compression, provided it be in a form suited to resist flexure; but the effects of flexure will seriously diminish the safe unit-strain for pillars or unbraced cast-iron arches, in which the line of pressure may vary so as to alter the calculated unit-strain very materially, perhaps as much as 50, or even 100 per cent. In practice, the safe working-strain of cast iron arches rarely exceeds 3 tons per square inch. For instance, the calculated working strain in the Severn Valley Bridge, carrying the Coalbrookdale Railway, 200 ft. span and 20 ft. rise, is between 2½ and 3 tons per square in., while that of the centre arch of Southwark Bridge, 240 ft. span, is about 2 tons per square inch.

The French Ministerial limit of working strain for cast-iron in tension is one kilogramme per square millimetre (= 0·635 tons per square inch), and in compression five kilogrammes per square millimetre (= 3·175 tons per square in.), and the table (given in the work) prepared by M. Poirée, engineer of Ponts et Chaussées, illustrates some of the best French practice in cast-iron arches.

The direct tensile strength of cast-iron may be tested in the manner described in 182, but it is also usual to prove its transverse strength by breaking small rectangular bars made of the same metal, and at the same time, as the principal castings. The following tests were applied in the case of the cast-iron sleepers provided for the Great Indian Peninsula Railway:—The mixture of metal is to be such as will produce the strongest and toughest castings, and is to be approved as such by the consulting engineer. The contractor must cast twice each day, from the same metal as that used in the sleepers, two duplicate bars 3′ 6″ × 2″ × 1″, and two duplicate castings of the form shown on the contract drawing, and exactly 1″ square for a length of 1½″ in the middle. One of the two bars must be tested on edge, on bearings 3 ft. apart, by placing weights on the centre thereof, to ascertain its elasticity and breaking weight; and one of the two castings must be tested in a suitable machine of approved construction to ascertain the tensile strength of the iron. The company's inspector will reject all sleepers cast on any day when each of the bars will not bear 30 cwt. placed on the centre without breaking, or when each bar does not deflect at least 0·29 of an inch before fracture, and when each casting will not bear a tensional strain of 11½ tons per square in. of section. Three sleepers will also be tested each day by a weight of 3¾ cwt. falling through 5′ 6″, the same having previously been subjected to blows from the same weight falling through 2′ 0″, 2′ 6″, 3′ 0″, 3′ 6″, 4′ 0″, 4′ 6″, and 5′ 0″ successively after the sand foundation (which shall not be more

than 24 in. thick under the centre of the sleeper, and laid on a cast-iron bed plate 8 inches thick, and weighing 2 tons,) has been well consolidated to the satisfaction of the consulting engineer or his inspector; and whenever every sleeper, so tested, does not bear these blows without cracking, or showing other signs of failure, the day's make will be rejected. Immediately after every sleeper is cast, it must be protected in a manner which will satisfy the company's engineer, that the process of cooling will proceed so slowly that its strength will not in any degree be diminished by too rapid or unequal cooling. Some engineers consider this proof rather high, and specify that test bars, 2 × 1 in., placed edgeways on bearings 8 ft. apart, shall support a weight on the centre of 25 cwt., as it appears that sleepers can be obtained which would stand better, as far as blows went, without using so high a bar test as that above described. It is a singular fact that there is an excess of about 16 per cent. in the weight that a 2-in × 1-in. test bar will support when cast on edge and proved as cast, over that which it will support when proved with the underside as cast placed at the top as proved, and 8 per cent over the weight which the same test bar will support if cast on its side or end, and proved on edge. Hence, cast-iron girders should be cast with the tension flange downwards in the sand.

474. Working Load on Cast-iron Pillars.—Owing to the want of recorded information it is difficult to assign what proportion of the breaking weight eminent engineers have considered to be the safe working load for cast-iron pillars. The opinions elicited by the Commissioners appointed to inquire into the application of iron to railway structures throw little or no light on the matter, as the evidence was chiefly confined to the strength of girders under transverse strain. Navier gives 1-5th of the breaking weight as the safe load in practice. Francis, an American engineer, also gives 1-5th; while Morin adopts 1-6th. My own experience leads me to recommend that cast-iron pillars supporting loads free from vibration, such as grain, should in general not be loaded with more than 1-6th of their calculated breaking weight In factories or stores, where strong vibrations from machinery occur, the working load should not exceed 1-8th; and if the pillar be liable to transverse strains, or severe shocks, like those on the ground floors of warehouses where loaded waggons or heavy bales are apt to strike against them, the load should not exceed 1-10th of the breaking weight, or even less when the strength of the pillar depends rather on the transverse strain to which it is liable than the weight it has to support. For instance the pressure of wind against a light open shed, supported by pillars, may produce a transverse strain which will be very severe compared with that due to the mere weight of the roof. The same thing may occur if heavy rolling goods, such as casks, or loaves of sugar, are piled up against the pillar in such a manner as to cause horizontal pressure like that of a liquid. It is also necessary to take into consideration the foundations on which the pillars rest, for, if these yield unequally, one pillar may sustain much more than its proper share of load. Wrought-iron is gradually superseding cast-iron for struts in machinery; when, however, cast-iron is adopted, it is well that the working load should, at all events, not exceed 1-10th of the calculated breaking load. In all these cases it is essential to consider carefully whether the pillar is flat bedded or very securely fixed at the ends, as a slight imperfection in this respect, either immediate or prospective, will reduce the strength to one-third in long pillars, and somewhat less in medium pillars, and if there is any doubt whatever on this point it will be only common prudence to assume in the calculations that the pillar is imperfectly bedded (311, 312). The reader will find practical rules for the thickness of hollow cast-iron pillars in 324, and examples of calculation from 322 to 329.

475. Effects of Repeated Deflections on Wrought-iron Bars and Plate Girders.—Sir Henry James and Captain Galton made some experiments in Portsmouth Dockyard for determining the effects produced by repeated deflections on wrought-iron bars. These experiments were made with cams caused to revolve by steam machinery, which alternately depressed the bars and allowed them to resume their natural position for a great number of times. Two cams were used; one was toothed on the edge so as to communicate a highly vibratory motion to the bar during the deflection; the other, a step cam, first gently depressed the bar and then released it suddenly when the full deflection had been obtained. The depressions were at the rate of from four to seven per minute.

476. Net Area only Effective for Tension—Allowance for the Weakening Effect of Punching—Rule of Board of Trade for Wrought-iron Railway Bridges—Tensile Working Strain of Wrought-iron—French Rule for Railway Bridges.—The reader will recollect that the whole area of a rivetted plate is not available for tension, but only the unpierced portion which lies between the rivet holes in any line of transverse section; this is called the *net* area of the plate, and on this net area alone the working tensile strain should be calculated. The *effective* tensile area of a punched plate is, indeed, somewhat less than its net area, for the tearing strength of iron is generally injured by punching, especially if there be too great a clearance between the punch and die, or if the iron be brittle, and, though it is not the practice, it would be more correct to diminish the gross section by the sum of the rivet holes multiplied by a factor greater than unity, perhaps 1·1, or 1·2. It may, perhaps, be supposed more accurate to add a constant quantity, say 1-8th inch, to the diameter of each hole in place of adding a percentage, but it is probable that the weakening effect of punching is greater the thicker the plate, and as thick plates have generally larger rivet holes than thin ones, the percentage allowance will be more accurate in practice. Good experiments on this subject are much wanted Meantime, the weakening effect of punching affords an argument in favour of drilling holes, especially in hard and brittle materials. Punching will probably do little injury to soft and ductile iron, or to mild steel, especially when the latter is subsequently annealed (462). The following rule has been laid down by the Board of Trade for the strength of railway bridges "In a wrought-iron bridge the greatest load which can be brought upon it, added to the weight of the superstructure, should not produce a greater strain on any part of the material than 5 tons per square inch." This rule is now confined to parts in tension, in which case the 5 tons is computed on the *net* area only, while the usual limit of strain in the compression flanges is 4 tons per square inch of *gross* area, and, as the tearing and crushing strengths of ordinary plate iron are, respectively, 20 and 16 tons per square inch, the foregoing rules are equivalent to stating that 1-4th of the breaking strain is the maximum safe working strain for wrought-iron girders which are subject to vibration like railway bridges, and this is now the recognised English practice. When wrought-iron girders support a dead load, like water tanks or grain lofts, they will safely bear one-third of their breaking strain, but when liable to sudden severe shocks, as in gantries or cranes, the working strain should not exceed one-sixth of the computed breaking strain.

The safe tensile working strain for ordinary bar, angle, or tee iron in girder-work, is generally the same as for plates, namely, 5 tons per square inch of net section, but, bar iron of extra quality, such as the links of suspension bridges, will safely bear 6 tons per square inch. Special care is taken with the manufacture of this class of iron, and it is customary to prove each link individually to a strain of from 8 to 10 tons per square inch before it is admitted into the supension chain, the tearing strength of the iron being not less than 24 tons per square inch. For merely temporary purposes wrought-iron will bear safely a tensile strain of 9 tons per square inch, unless when subject to violent shocks, in which case 6 tons will be sufficient.

The French rule for wrought-iron railway bridges is that in no part shall the strain, either of tension or compression, exceed 6 kilogrammes per square millimetre, *i.e.*, 3·81 tons per square inch of gross section.

477. Gross Area Available for Compression—Compressive Working Strain of Wrought-iron Flanges of Wrought-iron Girders are Generally of Equal Area. The total sectional area of a riveted plate is available for compression (flexure being duly provided against), since the thrust is transmitted through the rivet just as if it were a portion of the solid plate, for, if the rivet head be properly hammered up, its shank will upset and fill the hole completely Even supposing that the rivet do not perfectly fill the hole, an exceedingly small motion of the parts, which must take place before crushing commences, will cause the strain to pass through the shank. In practice, however, the longitudinal contraction of each rivet in cooling will produce an amount of friction between the surfaces riveted together which is generally sufficient to resist any movement so long as the strain lies within the usual working limits (466). The crushing strength of wrought-iron is generally taken at 16 tons per square inch (297), and the safe limit of compressive working strain in girder work is, according to ordinary English practice, 4 tons per square inch over the gross area, provided the section is so large that it can without extra material be put into a form suitable for resisting flexure or buckling. This is generally the case with the compression flanges of girders. When, however, a thin sheet, like the web of a plate girder, sustains compression, or when the theoretic section of a strut is small, as in the compression bars of a braced web, it is necessary to add additional material to prevent flexure or buckling. Angle, tee, or channel iron are suitable for plate stiffeners or for short struts; for long struts the plan of internal cross-bracing, represented in Plate IV., may be advantageously adopted, the cross-bracing, of course, not being measured as effective area to resist crushing, since it merely keeps the sides in line, but sustains none of the longitudinal thrust, and in small scantlings it will be prudent to limit the *maximum compressive* working strain to 3 tons per square inch. The working strain of wrought iron pillars, when subject to shocks, like the jib of a crane, should not exceed 1-6th of the computed breaking weight, with quiescent loads 1 4th is a safe rule. The reader is referred to 330, and the following articles, for the mode of calculating the strength of wrought-iron pillars of various sections

When wrought-iron arches have braced spandrils, the ribs are free from transverse strain, and will safely bear as high longitudinal strains as the flanges of girders, but if the spandrils are not braced, the line of pressure in the ribs may vary under the influence of passing loads, and thus double, or even treble, the normal working strain (219). The extreme compressive strains, produced by the most unfavourable combination of circumstances in the wrought-iron arched ribs of the Victoria Railway Bridge, in four spans of 175 ft each, which was designed by Mr John Fowler, are said in no case to exceed $4\frac{1}{2}$ tons per square inch.

The flanges of wrought-iron girders are generally made of equal, or nearly equal,

area, for the deduction for rivet holes in the tension flange is compensated by the higher unit-strain in the net area between the holes which is effective for tensile strain.

478. SHEARING WORKING STRAIN—PRESSURE ON BEARING SURFACES—KNIFE EDGES.—The shearing strength of wrought iron is substantially the same as its tensile strength (394), from which it follows that the shearing working strain of iron rivets or bolts in ordinary girder-work may equal 5 tons per square inch of section, but, as already stated in 462, the rivet area of a tension joint is usually about 10 per cent. in excess of what this rule allows, in order to compensate for accidental inequalities in the distribution of strain among the rivets. When calculating the area of a plate web from the total shearing strain in the manner described in 54, it is a safe rule to adopt 4 tons per sectional inch of web as the maximum shearing unit strain, but this rule gives no idea of the amount of material requisite for stiffening the web, and which can only be determined by experience in each separate case (430). The bearing surface of a round bar, such as the pin or bolt of a flat link, is measured by the product of its diameter by the length of bearing, and it appears from the experiments referred to in 161, that the statical working pressure on a bearing surface of wrought-iron may equal 1·5 times the safe tensile strain, that is, it may equal 7·5 tons per square inch of bearing surface. The pressure of rivets in double shear against the middle plate, supposing friction does not affect the bearing pressure (166), is often double of this, and the pressure of the links of a chain against each other must also be far greater. The rule of the Board of Trade for the steel knife edges of public chain-testing machines requires that the pressure shall not exceed 5 tons per linear inch of knife edge. In my own practice I have frequently put a pressure of 10 tons on each linear inch, and occasionally 17 tons and found no bad effects.

Strength of Materials and Structures.

Part I.—The strength of materials as depending on their Quality, and as ascertained by Testing Apparatus. Part II. The Strength of Structures as depending on the Form and Arrangement of their parts, and on the Materials of which they are Constructed. By JOHN ANDERSON, C.E., LL.D., F.R.S.E., Superintendent of Machinery to the War Department, &c. ("Text-Books of Science" series.) London: Longmans, Green, and Co. 1872.

The reputation of the author of this treatise stands so high, whether as a scientific or as a practical man, that it seems scarcely necessary to say that the present treatise is a most valuable addition to the literature of practical science. Its character, and contents are very truly described in the author's prefatory remarks, as being divided into two distinct parts.

The First Part treats of the natural properties of various materials employed in construction, more especially in regard to their strength and elasticity, and their adaptation for particular practical purposes in the arts. The object of this portion of the work is to describe the qualities and characteristics of materials, so far as they are of importance to the engineer, or are exhibited in the results of experiments made with the testing machine.

As it cannot be expected that all will have the opportunity of making experiments for themselves, the first three chapters are devoted to the testing of materials, and to the practical manipulation of a testing machine. In these chapters reference is made to the physical properties of some common materials, by which the student will be able to comprehend the nature of such experimental investigations, and the labour and care needed in order to arrive at true results; and it is hoped that he will be able to comprehend the nature of such experimental investigations, and the labour and care needed in order to arrive at true results; and it is hoped that he will find the subject treated in such a clear and simple manner, that he may understand it without much difficulty.

The fourth, fifth, sixth, seventh, and eighth chapters refer more especially to cast iron, wrought iron, steel copper, alloys, and timber, and are intended to describe their qualities and leading peculiarities.

The ninth, tenth, and eleventh chapters treat, more generally, of the resistance of materials to torsion, shearing, and punching, and to transverse strains, conjoined with impact and vibration.

The first eleven chapters, therefore, have regard to the nature of materials, and the remaining six chapters which constitute the second part of the volume are devoted to the strength of structures, when made of the materials previously treated of.

In the Second Part, the student will learn the correct forms which must be given to the various structures in order to obtain the requisite strength, and likewise the best arrangement of materials, as depending on their respective properties, so that by the practical application of correct principles, the maximum of strength may be attained with the minimum of weight and cost.

The experiments most frequently referred to, and which are quoted as "Woolwich experiments," have all been made in the Royal Arsenal for various purposes during the past eighteen years, and chiefly with the American testing machine, which is described in the third chapter, the only exception being certain experiments, to ascertain the strength of ropes under various conditions, which were carried out with a hydraulic testing machine, recently transferred from Her Majesty's Dockyard to the Royal Arsenal.

The author states that, although he has taken pains to ensure accuracy, still, when so many figures have been necessarily transcribed several times, more particularly in the tables, some errors may probably exist. In this part of the work Mr. Charles Tepple and Mr. George Cuthbert have both rendered valuable assistance, the former, more especially, in regard to the chapters on structures, where calculations were concerned. Most of the examples given are taken from actual works, which have passed through the author's hands during the past few years.

The sources from whence the results of other experiments have been drawn, or from which extracts have been made, are generally quoted. Reference has very frequently been made to the Blue Book, containing the report of the Commissioners appointed to inquire into the Application of Iron to Railway Structures.

Perhaps as useful and interesting portion of the work as any is that referring to steel.

"Steels differ from each other in many respects, but more especially in regard to the degree of steeliness, and, within certain limits, any degree of steeliness may be obtained. In making fine steel by the cementation or common process, bars of pure wrought iron are enclosed in a fire-clay box, and surrounded with powdered charcoal. The whole mass is then kept at a red heat for a certain period; the porous molecular structure of the iron is opened, and the carbon vapour finds its way into the body of the iron. The bars of iron are subjected to this process for a period generally ranging from five days to a fortnight, or even longer, according to the quality required; the longer the process is continued, the more steely does the bar become.

As some of the bars have a greater opportunity of absorbing carbon than others, and from other contingencies, the steeliness of the batch varies, and uniform quality can only be obtained by breaking the bars into small pieces, sorting these fragments into lots, judging by the appearance of the fracture, and then melting the lots in a crucible. The liquid steel is cast into an ingot, and hammered or rolled into the cast steel of commerce. In casting very large masses, a great number of crucibles are necessary, and as these must all be ready for pouring at the same time, and must be emptied into the mould consecutively, the successful casting of heavy ingots requires a very good organization.

"In the arts, cast steel is required of all degrees of steeliness. The milder sorts of steel are only a little more steely than the harder varieties of wrought iron, and the mildest quality may contain about ¼ per cent. by weight of carbon. The highest qualities contain as much as 1 per cent. of carbon, and there are many intermediate qualities. As compared with hard wrought iron, mild steel, while not containing much more carbon, is yet more perfectly homogeneous in its granular structure, and is superior to it both in strength and in almost every other good quality.

"A good serviceable quality of steel, for many purposes, is now extensively made by the 'Bessemer' process, which appears to be, at first sight, a reverse method to the cementation system described above. The Bessemer process commences with cast iron in the crude state, which is melted and poured into a vessel, and, while liquid, a strong current of air is passed through it. The carbon in the iron is burned out, by the oxygen contained in the air passing through the molten mass, and the other impurities are gradually eliminated, until at length the iron is in condition of comparative purity, and chemically similar to wrought iron. In order to make it into steel, there is added to this purified metal a measured portion of a pure cast iron, generally that called '*spiegeleisen*,' or 'looking-glass iron,' containing a large and definite quantity of carbon, which converts the pure iron into a steel sufficiently good for an immense variety of applications. From the circumstance that steel may be produced by this process at a less cost than by the former method, it is, to a large extent, taking the place of wrought iron.

"Steel, like wrought iron, is much improved in its nature by being thoroughly worked either under the hammer or by rolling. Like most metals, steel is found to be more or less porous after casting, which is due to small air or gas bubbles which have not been able to find their way to the surface, the effect of hammering or rolling is to consolidate the mass, and to render the grains of the metal finer, denser, and stronger.

"During the last few years, Sir Joseph Whitworth has been engaged upon a course of most valuable although most expensive experiments, conducted with powerful apparatus. These experiments have for their object the attainment of steel of great density and general goodness, by combining the best materials and the most thorough working, and using every care that the best skill can devise. In Sir Joseph Whitworth's system, after the liquid steel is poured into a metal mould of sufficient strength, a piston or plug is inserted, upon the top of which there is at once brought to bear the full force of 8,000 tons of hydraulic pressure. The effect is at once perceptible, a corresponding pressure pervades the liquid steel, the porosity is overcome, and the metal shrinks rapidly by the sudden closing up of its pores. The shrinking continues for some time at a rate perceptible to the eye, and afterwards more slowly, for a period of nearly a quarter of an hour. Some of the shrinkage observed is due to the decrease of temperature, but it is mainly owing to the hydraulic pressure.

"In considering the effect of pressure, as compared with a blow, in the consolidation of a mass of steel or iron, it would appear that the former should be the most effective, because the metal acted upon has not an opportunity of lateral yielding, whereas in either hammering or rolling, the metal flows

away from the point of impact of the hammer, or squeeze of the rolls. Such is the view taken by Sir J. Whitworth. Hence when the ingot, which has been compressed in the liquid state, is taken out of the mould, it is brought to a working temperature, and is then subjected to a series of squeezing operations by hydraulic pressure, squeeze after squeeze being applied until the required dimensions are arrived at; this hydraulic pressure does not act without control; a dial and pointer shows the amount of compression of the mass, and so prevents any risk of over squeezing and making the article too small. The whole process is carried out with such ease, and is so gentle in its action upon the tools that are employed, that, on seeing the process performed, it is impossible not to feel that it is a great step in the right direction, and it is encouraging to find a man with the courage to go into such gigantic enterprises, for the purpose of advancing practical science.

"The goodness of steel may be said to depend on three things: first, the materials selected; second, the nature of the working to which it is subjected; and, third, the care taken by the makers. These three conditions apply to all descriptions of steel, from mild to high, and each quality is equally good for its own special applications.

"The quality of fine cast steel suitable for cutting tools, contains a larger percentage of carbon than either the milder varieties of cast steel, or the varieties of Bessemer steel, which are taking the place of wrought iron, or even the fine cast steel that is used for the lining of guns. The gun steel contains about ·03 per cent. of carbon, and in its natural state has an ultimate tenacity of from 30 to 35 tons, but when made red hot and cooled in oil, its ultimate strength rises to 40 or 45 tons per square inch. The apparent elastic limit of short specimens rises in an equally remarkable degree, being for untempered steel specimens 10 to 15 tons, and for steel tempered in oil, 28 to 32 tons per square inch. The toughness is also increased, so that the tempered steel may be bent, twisted, or drawn out to a degree, far beyond that to which it would submit in the untempered condition.

"It will thus be seen that the limit of elasticity of mild cast steel, when tempered in oil, is fully equal to three times that of wrought iron. This is an important consideration, which will in time determine the extensive use of that material, and more especially, because it stretches so much before final rupture takes place, which is a very valuable and important property.

"The marked increase in the tenacity of cast or Bessemer steel, as compared with wrought iron, has already led to the application of the latter for many purposes where iron was formerly used, and wherever strength requires to be combined with lightness. In the case of rough structures, such as girders or bridges, the use of steel will gradually advance, the chief difficulty in the way of its more general application being, not so much the difference of cost, as the fact that the engineer is unable to determine whether good steel has been really employed by the contractor; testing would settle the point, but the trouble and expense of testing every bar or plate is a serious practical barrier to the adoption of this plan. It has been suggested that the specific gravity of a cutting from each part of a structure might be taken, steel being 0·1 per cent. heavier than wrought iron, but the difference is so small that the distinction of the quality by that test is rather too delicate for practical purposes. It has also been proposed to take some of the punchings from the plates, to draw them out to a small bar at a smith's forge, and to test them either for tenacity, or by tempering with fire and water in the usual manner. All such testing, however, is not in accordance with the usual practical notions of the workshop at the present stage of our progress.

"In a wide range of experiments made with ordinary cast steel, when in its natural or untempered state, the ultimate tenacity was found to vary from 114,000 lbs. down to 67,000 lbs., the highest being a little over 50 tons, and the lowest a little under 30 tons per square inch; but specimens of steel are often met with both of greater and of less strength than the foregoing. A cast-steel specimen of extreme softness, cut from a Krupp gun, gave an ultimate tenacity of 72,000 lbs., which is very remarkable when the extreme softness of the specimen is borne in mind.

"It might be inferred that the strongest quality of steel was always the best, but it is not so, the amount of tenacity which is desirable depends altogether upon the purpose for which it is to be used, the weaker and softer, or less steely qualities, being more tough, are preferred for many purposes, more especially for structures exposed to vibration.

"The effect of tempering upon steel is to increase its strength, and when the chill is rapid to render it harder and more brittle. In tempering ordinary articles they are first heated to redness and then cooled in water, and thereby made over strong and over hard, and unfortunately very brittle, these defects are then subdued by the application of a gentle heat, which is continued or increased until the required degree of temper is attained.

"The strength is determined by two things: first, the steeliness of the steel, that is, the proportion of carbon which it contains, and second, the rate of cooling. The highest degree of strength is obtained by selecting a high steel, heating it to a dull red, and then chilling it rapidly. These two conditions give a degree of strength combined with toughness, far beyond that which is obtained by giving a higher degree of heat, then chilling it suddenly, and afterwards reducing the temper."

We could quote other portions of the work with confidence in being able to secure the attention of our readers, but the limits of our space will not permit us to do so.

Elementary Chemistry. By F. S. Barff, M.A., Christ's College, Cambridge, Professor of Chemistry at the Royal Academy of Arts, and late Assistant Professor of Chemistry, University College, London, with illustrations. Cassell, Petter, and Galpin, London, Paris, and New York.

As might be expected, from the high reputation of its author, this is a valuable treatise and though of elementary character, demands from us definitive exposition of its character and contents. Mr. Barff states that the book, as far as it goes, professes to enable the attentive student to acquire a sound knowledge of the various elementary facts concerning the most important of the "non-metallic elements," as they are called. It is written for young boys of ordinary abilities, who understand arithmetic as far as proportion or rule of three. The writer's object is to ensure such a sound grounding in chemical science, that the knowledge acquired will enable the student to go on a step further, and easily understand symbolical notation and the more difficult facts concerning the bodies which he has studied; or, should any boy who has learnt what is taught in this book go on further, that he may still have a useful though but a limited knowledge of chemistry. A further, and as he believes a still more important object, the writer has had in view, namely, the mental training of young boys, who will, he hopes, by the system he has adopted, have their reasoning faculties strengthened, and their powers of observation rendered accurate and acute. From some experience in teaching boys, the writer believes that at first they should not be compelled to commit names and quantities to memory, but should be required to observe the experimental illustrations carefully, and that they should be required to explain the experiments and apparatus, even though they cannot recollect the names or proportions of the substances employed. They should, however, have their properties impressed on their minds. By this is meant that they should know, for example, that in making hydrogen a metal is used, and an acid, or some liquid which contains hydrogen, and that the hydrogen comes from it, not from the metal or from the water, and that the water is used to dissolve the solid formed when the hydrogen has gone away, or when potassium or sodium are made to act on water. If they forget the names of the metals at first, no matter; they should, however, be made to recollect that they are soft, lighter than metals generally are, that when exposed to air their metallic lustre is soon dimmed by a white film, and what follows when they are thrown into water. A number of questions for calculation are given in Chapter XVI.; if these are worked out, pupils will soon, it is said, learn without effort the proportionate numbers in which the substances treated of combine, and by constant reference to the chapters where these are treated of, which will be necessary in order to work the questions out, they will soon get accustomed to the names, and will recollect them without effort. In order to ensure the use of language which could be understood by boys, the writer dictated most of the chapters to one of his pupils at the middle school, who took them down in shorthand from his dictation; the boy who did this was a thoughtful boy of about thirteen years old, and any phrase used which he could not understand, was so changed as to make it intelligible to him. By adopting this course the writer hopes that he has adapted his instructions to the capacities of the general run of boys. Chapter XV. is devoted to an explanation of the illustrations, with instructions how to set up apparatus.

These statements afford a fair *exposé* of the character and contents of the work.

Elementary Lessons in Applied Mechanics (Cassell's Technical Manuals.) By Robert Stawell Ball, LL.D., Professor of Applied Mechanics and Mechanism in the Royal College of Science, Dublin, Author of "Experimental Mechanics," with 140 questions for examination. Cassell, Petter, & Galpin, London, Paris, and New York.

It would be impossible to speak too highly of this little book. As a strictly educational work, it is well worthy of hearty commendation, but we hold it to be something beyond this—a useful handy book of reference, as regards the typical forms, and constructions of most of the important implements and machinery adopted, with brief dissertations on the scientific principles involved in their construction and use.

The following explanation of the nature and construction of a class of hydraulic mechanism (the hydraulic ram) not, in general, so well understood as it should be, is worthy of attention.

In this explanation, however, the author refers, as he usually does, to an illustrative diagram, which we are compelled to dispense with, and in consequence, to somewhat alter the wording of the passage. A tube, closed at one end, is provided, along which water flows in the direction of the closed end. This tube receives the water from a stream, and the object of the machine is to send a portion of the water up to a higher level. The tube has a valve near the closed end, which valve is capable of being nicely adjusted, its weight is such that the ordinary pressure of the water beneath is not sufficient to keep it closed; thus the valve falls open and the water flows out. The velocity with which the water flows is gradually accelerated while the valve

open, and the pressure consequently increases. When the pressure of the water attains a certain value the valve is pressed upwards and closed. The water which was flowing along the tube is thus suddenly checked. We have already learned that a body in motion exerts a large force when its motion is checked. Water is no exception to this rule. The mass of water suddenly exerts a large pressure and forces open a valve leading to an air chamber in which the air is compressed; a pipe leads from this air chamber and carries up the water to the height required. The pressure in the air chamber depends upon the height to which this latter pipe is carried, but whatever be the pressure the valve will be forced open by the water, a small quantity of which will be driven into the air chamber. When the water has come to rest this valve shuts. The same operation is now repeated, the other valve nearer the closed end drops open in consequence of the pressure not being sufficient, and the cycle again commences. Thus at each operation a small quantity of water is forced into the air chamber, and ultimately must ascend by the before-mentioned pipe leading up therefrom.

The inertia of water which is so ingeniously applied to the hydraulic ram, has to be attended to in the fittings which are used in towns supplied with high pressure of water. Ordinary stop cocks cannot be used in pipes in which the pressure amounts to over 80lbs. upon the square inch. If the water be turned off suddenly, as it is by an ordinary cock, a rattling noise is heard, and a violent strain is produced upon the pipes and fittings which will sooner or later lead to rupture. The remedy is obvious. The force which a body exerts when its motion is arrested varies according to the manner in which the motion is stopped. If the motion be stopped gradually the force is very small; if suddenly, prodigious. The plan is then to cut off the water gradually. This is done by using a cock in which by means of a screw the aperture is closed or opened gradually. The author then proceeds to describe in detail the mechanical arrangements adopted for the above object, but it would be idle for us here to follow him without the aid of the illustrative diagram he refers to; so we must leave such of our readers as desire fuller information on this matter to resort to the work itself.

The substance of this volume, which has been already published in "Cassell's Technical Educator," is divided into Parts and Lessons. In Part I. the mechanical powers are explained and illustrated, Lesson 1 referring to the lever, Lesson 2 to the screw, Lesson 3 to the pulley; Lesson 4 to the pulley-block; Lesson 5 to the crane, Lesson 6 to the hydraulic press. Part II. refers to tools, and Lessons 8 to 12 have for subjects the hammer, the turning lathe and the slide-rest, the planing machine, the drilling machine, the steam-hammer, the shearing machine and the punching machine. Part III. deals with special applications comprised by Lessons 13 to 18 the girder, machines for raising water (from which we have taken the explanation as to the hydraulic ram), machinery used in sawing timber, the flour-mill, machinery used in the manufacture of sugar, machinery used in the spinning of cotton; and the work concludes with 140 questions for examination.

Steam in the Engine: Its Heat and its Work. By P. KAUFFER, Managing Engineer, Leeds. London: Blackie and Sons, Paternoster buildings, E.C.; Glasgow and Edinburgh. 1873.

WE commend this small book on a very interesting subject to the favourable consideration of our readers. It professes to embody the author's practical experience, viewed by the light of data, derived from the experiments of Joule and Regnault. We have no time to say more at present, but hope to revert to this work at an early opportunity.

General Literature.

Some Talk About Animals and Their Masters. By the author of "Friends in Council." Strahan and Co.

THE excellence of Sir Arthur Helps' books has been universally acknowledged. There is a quiet beauty in the style, and sometimes a vigorous, but measured force in the thought which please and elevate. They are particularly suited to those who possess leisure to go carefully over their contents and whose minds have been sufficiently cultivated to appreciate the wide range of thought and reading by means of which he multiplies his arguments and illustrations. Sir Arthur's books cannot be favourites with those whose lives are given to daily toil, or whose time is occupied with the business struggles of the world. They should be read in well-appointed libraries, or in drawing-rooms that look out on smooth lawn bordered by flowering shrubs, with the green heads of old trees nodding to each other in the distance. Very handsomely bound, they would look charming on Millenial book-shelves, for there, with nothing to do, the calm, happy-minded inhabitants could discuss with no more of a shudder than gave a richer zest to their golden moments, the old barbarities of the world such as the bearing-rein of the draft-horse, the unkind words spoken to cat or dog or the cruelties inflicted on geese in transit by close packing. As matters stand in this tough old working world, where men thrash their wives and costermongers belabour their donkeys, and a million paupers are always dying by inches on public charities, and men ruthlessly slaughter each other by hundreds and thousands in Franco-Prussian wars, there is not much time outside of well-appointed drawing-rooms to sympathise with dogs or cats, unless such as are made subjects of vivisection, or with geese, except such as are fed to death before a slow fire, that their enlarged livers may be suitable to make delicious *pâté fois gras* for the tables of high-born people, who have little else to do beyond coddling their appetites and nursing their sympathies.

Admitting all this, however, there is still much to be said in favour of Sir Arthur Helps' volume. Its quiet and graceful conversations, without any excitement of feeling, or any exaggeration of language, ramble over a great variety of subjects, and not one of these is left without some fact being brought to light, or some observation being made, in which the reader will find both pleasure and improvement.

It is not all about animals and their ways in reference to men, and the treatment they receive from men. Where for instance could a better definition of scandal be found than this, given by a little girl at a school examination: "Nobody does nothing, and everybody goes on telling of it everywhere." Or where could we put our hand on a better bit of covert truth than the following:—"Everything seems clever and uncommonplace in a language of which you know but little; and that is why we appear such clever and interesting fellows to dogs. If they knew our language well would any dog sit out a public dinner." The rules laid down at pages 36 and 37 for writing on matters connected with real life are excellent, and if followed would certainly ensure precision and clearness. Then, by way of diversity, there is a plea for applying "drags" for the purpose of stopping "busses," not only for the comfort of the horses, but for the safety of the public. After this we stumble on a curious reference to Bishop Berkley's "Querist," a book which nobody reads now, perhaps, for the reason that it is too old and dry for Mudie's Library, but which is, nevertheless, in much of its contents a curious anticipation of many questions which we, in the fuller development of our beaver faculty, are only beginning to discuss. Present controversies about technical education, had a curious anticipation in the following queries of the good old bishop:—

"Whether France and Flanders could have drawn so much money from England for figured silks, lace, and tapestry, if they had not had academies for designing.

"Whether our linen manufacture would not find the benefit of this institution; and whether there be anything that makes us fall short of the Dutch in damasks, diapers, and printed linen, but our ignorance in design.

"Whether those who might slight this affair as notional, have sufficiently considered the extensive use of the art of design, and its influence in most trades and manufactures, wherein the forms of things are often more regarded than the materials."

There follows this many well-selected passages from old writers on the treatment of animals which may be read again and again as few things can be better as an occasional study than such shreds and patches of wisdom when judiciously selected and cleverly-worked into the web of a story or treatise, but we prefer pointing out such new things as may be regarded as original. A wise old father, several of whose younger relatives stood for Parliament, and who were all rejected but one, and he, as it happened, was by many degrees the least qualified of the lot, when asked the reason why the best qualified were rejected and the worst accepted aptly replied, "Oh, his nonsense suited their nonsense," and how much of human life this answer explains. "You don't win people by talking their sense to them, but by talking their nonsense to them, which they are fondest off. And then if you can talk the right nonsense to the right people at the right time, you must succeed." A valuable short sermon on a pleasant text, which, no doubt, will be amply illustrated at the general election now, we presume, approaching. The right nonsense to the right people in the right place has its completeness and power verified when candidates meet constituents, if not, then the statement cannot be true anywhere on this our globe.

Passing on to something better, we notice the following as a pleasant truth worth making known: "The reason why great literary men and great statesmen are such interesting companions, is, not only that they have a very wide range of subjects, but that they are generally very anxious to persuade their companions of something, to bringing them round to their way of thinking, and their earnestness is contagious, and creates earnestness and therefore, pleasure in the soul of the hearer. And, in general, these men are delighted with any companion who is appreciative and receptive, whatever his other gifts or failings may be." The conversation on companionship, with which the book finishes, is very good; but we shall extract no more of it, as it will furnish pleasant reading to whoever has time to turn to it, and go leisurely over its instructive, pleasant, and polished pages. We should prefer it if there was more natural ruggedness and irregularity in it, more of the dash of thought, which creates enthusiasm in the reader. As it stands, however, it is very good, and will please many readers better than if it had more of the quality we ourselves desire to see in it.

(GENERAL LITERATURE Continued on p. 13.)

ENGRAVING IN JAPAN.—The Japanese Government propose to have an institution for the study of practical engineering, and have instructed their agents to procure a set of machinery and tools similar in all respects to that which the Crystal Palace Company, last autumn, constructed for the purposes of their admirable school for practical engineering, under the supervision of Professor Wilson, as principal.

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Monthly Notices.

A free library in the City of London—A proposition of Mr Macfie's—Technical Science instruction at Stationers' Hall—Proposed Law for Registration of Trade Marks—Dramatic Copyright—Resignation of the Secretaryship of the Meteorological Society by Mr J. Glaisher, F.R.S.—Re-appointment of Dr. Carpenter to the Swiney Lectureship—Metavanadic Acid—New source of Antimony—Professor Everett on Mirage—Memorial to Professor Sedgwick—Glacial deposits in California—Mr. R. Brough Smyth—Hematite ores in the Furness district—Observatory of Paris—Professor Guthrie on the relation of Heat and Electricity—News from Sir B. Frere's Expedition—Women's rights and the Pharmaceutical Society—Mr. W. Smith's experiments on Silenium—Coal in the Isle of Wight—Improvements in Puddling Iron—Glycerine as a solvent for coal-tar colours—Trade instruction in the Army.

A fact reflecting the highest credit on the City of London ought to receive the widest publicity, it has established, without calling upon the already overburdened ratepayers to pay new rates, a magnificent free library at the Guildhall, King-street, Cheapside—a place worthy of a visit, if only for the sake of its architectural beauties. The names of Dr. Saunders, the Chairman of the City Library Committee, and Mr. Overall, the Librarian, ought to be held in grateful remembrance by all Londoners for the efforts to obtain the above-mentioned result. And this fact may serve to cover a multitude of the sins of the City Common Council.

For once we approve of a suggestion made by Mr. R. A. Macfie, M.P., so well known for his anti-patent law proclivities. In a memorial by him, addressed to the Lord Chancellor, praying that he would take measures to re-arrange our Patent Office system, in accordance with the report of the Select Committee of the House of Commons on letters patent, he suggests that the Board of Patent Office Commissioners should comprise persons enjoying the confidence of "*Inventors'* and Engineers' Institutes." After this we think there is yet some hope for even Mr. Macfie!

We rejoice in being able to inform our readers that Technical Education, in connection with the City Guilds, is making further progress. The present Lord Mayor, Sir S. H. Waterlow, who is also, we understand, the Master for this year of the Worshipful Company of Stationers, has arranged for lectures to be given under the auspices of that company, with reference to paper-making, printing, printing presses, printing machinery, and other subjects connected with the stationery trade. We would venture to suggest that the company should hold examinations on the subjects of the lectures; that prizes be awarded, and that from the highest class of those who passed these examinations, young men should be selected for the presentation of the freedom of the Company gratuitously.

It has been recently announced that a Bill is shortly to be introduced into Parliament, providing for the Registration of Trade Marks, such a measure has long been recognized as a public necessity for protecting the *bona fide* trader, and as tending to protect the public against impostures by vendors of spurious wares.

Much correspondence has lately occupied the columns of the public journals in regard to copyright in dramatic works. The present law, which pays little regard to thoughts, and dwells much upon the form of words, in which they are clothed, is said by some to be insufficient in protective effect. Be this as it may, we warn literary men that they are treading on dangerous ground when they get away from the present system. It is the necessity of restraining *imitation* as well as *copying*, that creates much of the difficulty and expense of patent law suits.

Mr. J. Glaisher, F.R.S., is reported to have resigned the Secretaryship of the Meteorological Society which he has held from its foundation.

The Swiney Lectureship in Geology, which is tenable for five years, has been given to Dr. Carpenter, who was Swiney Lecturer some few years ago.

Meta-vanadic acid was recently the subject of a communication to the Manchester Philosophical Society by Dr. B. W. Gerland, in which he describes the preparation of this substance in the form of scales of a beautiful lustre and deep orange colour. "Vanadium-bronze," or gold-like substance, is said to be perfectly permanent in the air; and Dr. Gerland thinks it will become a favourite bronze, valued even higher than gold.

A new source of antimony of high quality has, it is expected, been discovered in the Italian Alps by Mr. W. P. Jervis, the Director of the Industrial Museum of Turin.

The *Athenæum*, in its Science Gossip, states that the optical principles of the curious atmospheric illusions known as the mirage have lately been studied by Prof. Everett, of Belfast. After investigating some of the laws which govern the formation of images in a medium of continuously-varying index of refraction, and thus establishing the law of ray-curvature, he applies these principles to the explanation of most of the phenomena of mirage, and points out the mistakes which previous writers on this difficult subject have frequently committed.

It is proposed to erect a memorial to the late Prof. Sedgwick, and it is rumoured that this is likely to take the appropriate form of a new Geological Museum at Cambridge.

Among the detrital materials forming the gold-bearing deposits in the deep "placers" of California, silicified trunks of large trees are by no means uncommon. These drift-deposits are probably of later Pliocene age, and are in many cases capped by an outflow of lava or other eruptive matter. The wood, whilst retaining its structure, has in some instances been converted into lignite previously to the silification, and occasionally fragments of the same tree resemble jet in one portion and opal in another. A specimen exhibiting this gradual transition from silicified wood to silicified lignite has been examined by Mr. J. A. Phillips, and his comparative analyses of the two portions are published in the current number of the *Geological Magazine*.

Mr. R. Brough Smyth, the indefatigable Secretary for Mines for the Colony of Victoria, has constructed a sketch of a new geological map of Victoria, founded on Geological Surveys made under the direction of Mr. A. R. C. Selwyn and his officers, and on surveys made by the Mining Department. This map, for its clearness and completeness, merits much commendation.

The deposition of certain hæmatite iron-ores in the Furness district, according to Mr. W. Brockbank, must be referred to

glacial action. These valuable ores occur partly in veins and pockets in the carboniferous limestone, and partly in the form of superficial deposits, filling hollows in the limestone, and covered only by post-tertiary gravels and clay. Mr. Brockbank believes that the ore in these superficial deposits has been transported from its original place of occurrence by the agency of ice, and re-deposited as drift wherever there was a cavity convenient for its reception.

The reorganization of the Observatory of Paris has been completed and confirmed by a decree of the President of the French Republic. M. Le Verrier has been appointed Director, with MM. Belgrand, Fizeau, Janssen, Tresca, Daubrée, Y von Villarceau, Wolf, and Gaillot Roy, for the Council. M. Marie Davy is appointed Director of Meteorological Observatory of Montsouris, Paris, and Dr. Stéphan, Director of the Observatory of Marseilles.

Les Mondes contains an important paper on the observations by which M. Janssen discovered the true nature of the Solar Coronna.

A new relation between heat and electricity has been studied by Prof. Guthrie. It is found that the re-action between an electrified body and a neighbouring neutral body, by which the latent electricity of the latter is decomposed by induction, becomes greatly modified when the temperature of the neutral body is raised. It appears that some of the phenomena observed in these researches admit of explanation by assuming the existence of an electrical coercitive force, and the diminution in the intensity of this force on an elevation of temperature.

It has been reported that Sir Bartle Frere and his suite, and also Lieutenant Cameron and Dr. Dillon, of the East Coast Livingstone Expedition, have arrived at Zanzibar. Lieutenant Cameron had suffered from fever, but was recovering when the mail left. Bagamoyo was to be left for the interior not later than the 18th Feb., other advices have since been received.

The advocates of women's rights will be interested to learn that at recent meetings of the Pharmaceutical Society the desirability of admitting ladies to the lectures and laboratory of the Society has been mooted, and certain names appearing as "apprentices and students," it was proposed at a Council meeting that they be elected, but after discussion the matter has been deferred.

According to experiments made by Mr. Willoughby Smith, the Electrician to the Telegraphic Construction and Maintenance Company, a bar of Selenium, when placed in the dark, upon having a current of electricity passed through it, and being then subjected to the action of light, the conducting power is largely increased, but diminishes again upon the withdrawal of the light. This result is ascribed to the luminous rays and not to heat.

The discovery of coal at Whitchurch Bay, Isle of Wight, has been announced; but it seems this discovery is the same as that of the beds of lignite described by Mr. Bristow in 1862.

The process of puddling iron is proposed to be shortened, phosphorous eliminated, and better iron obtained by the adoption of a plan which M. Th. Schurer brings under public notice in the *Bayerisches Industrie und Gewerbe Blatt*, that is, by mixing equal parts of the chlorides of calcium and sodium, which should be applied (in the proportion of about three times that of the quantity of phosphorous in the iron) whilst the latter is in the process of puddling.

Glycerine has been proposed as a solvent for coal tar colours, and is said to have been successfully tested in regard to them when applied in the dyeing of cotton, wool, and silk. Costliness, however, is likely to render nugatory this invention.

We learn from the *Times* that the Adjutant-General of the Forces has issued a general order, by direction of the Commander-in-Chief, with the view to the further development of the system of employment of soldiers at trades, and the formation of an efficient pioneer force in each regiment. Pioneers are to be at once selected by Commanding Officers on the following system—One Serjeant (a carpenter by trade if possible); three carpenters; two bricklayers, one able to plaster, and one able to slate; one painter and glazier; two plumbers and gasfitters; one smith, able to shoe horses; one mason, able to cut stone. To be throughly instructed in use of tools and in entrenching. The serjeant is to be sent to the School of Military Engineering.

MISCONCEPTIONS RELATIVE TO MEDICAL ELECTRICITY.

THE practical applications of electricity, resulting from the progress in electrical sciences, extend now over a large area, and every movement occurring in any of its branches is worthy of attention. It is a singular fact that the first useful application of electricity was that of restoring health. Ever since (a century ago) this branch of electrical utility has steadily progressed in spite of the many obstacles, which every new discovery is certain to encounter; it was successfully promoted first by outsiders, and then by scientific members of the medical profession, by whom electricity, as a curative, will ultimately be generally adopted. The improved means of practically applying this subtle power is an important item in the progress of electro therapeutics, and in the extensive, and ever-growing literature, explaining the various medico-galvanic appliances in use, we find side by side with other scientific apparata Mr. Pulvermacher's various inventions of Voltaic Chain Bands, Batteries, &c., frequently treated upon in terms flattering to the inventor. We must, however, confess that it puzzled us not a little to find inventions which are so honorably connected with science and represented in its literature struggling for existence by advertisements in those columns of the daily Press, which are accessible to all comers irrespective of merit. This raised doubts as to the identity of the articles advertised and those referred to in the scientific Press, but an opportunity having lately been presented to us of experimenting the apparatus, it at once brought home to our senses, physiologically as well as physically, its *bona fide* character and efficiency, thus removing our former misconceptions, and at the same time explaining why these chains have acquired such an honorable status.

By a glance at the construction of these chains, the connoisseur will at once recognise the clever manner in which the inventor has satisfied the scientific conditions for *electro generation* on the one hand, and those for *ease of application* on the other. The charging of these flexible batteries is instantaneous by the capillary attraction of acid (vinegar) effected by the metallic surfaces of zinc and copper placed in juxtaposition, close to, but not touching, each other, thus abolishing the trough and a great portion of the resistance of the exciting liquid in the old batteries. The corrected notion we now have acquired concerning these chain bands apart from the services they undoubtedly render both to scientific and popular medical electricity, is that the invention in its various modifications as to size, number of elements, and nature of exciting medium, has a great field for application in other directions, and, together with the various accessories, and are well calculated for familiarising the novice with this admirable force and the laws which govern it, seeing they may be illustrated by means of experiment at a minute's notice, and at little or no expense. As we have above seen, the success, both scientific and general, is owing to *great simplicity*, coupled with great electrical efficiency; and this has, therefore, induced various other persons to put forward contrivances professedly possessing similar powers and virtues; but these persons, either from ignorance of the scientific cause of the efficiency of Mr. Pulvermacher's appliances, or else dreading the penalties attending the infringement of his patent rights, claim to have found the secret of producing portable electric and magnetic contrivances without the use of an exciting liquid, and without magnets, thus endeavouring to mislead the uninformed. This could, however, be to a great extent averted, if Mr. Pulvermacher would undertake to lecture, and demonstrate by experiment, the scientific principles and practical application of his inventions. Sceptics would then become faithful believers, and mere imitators would cease to compete with him.

We trust these observations will induce persons interested in electricity as a curative to investigate these appliances more closely, and thereby satisfy themselves as to their *bona fide* nature and evident importance to scientific and popular medical electricity. The invention of Mr. Pulvermacher has been referred to in the following works:—

Bulletin de l'Académie de Medicine, Paris. Vote of thanks to Inventor. Vol. XVI., p. 13. ... 1857
Dr. T. Pereira, F.R.S., &c. Materia Medica, p. 53, ed. IV. ... 1854
Natural Philosophy—Dr. Lardner, p. 304. ... 1868
Local Electrization—Duchenne, p. 39 ... 1855
Electro Physiology and Electro Therapeutics—D. Garratt, of Boston, p. 117. ... 1861
Epileptic and Convulsive Affections.—C. B. Radcliffe, M.D., p. 180, ed. III ... 1861
Elements of Physics—Prof. Pouillet, p. 694 ... 1856
Becquerel on Electricity, its application in medical treatment, p. 36. ... 1857
Electricity and Medical Treatment.—Dr. O. Kowalewski, Vol. I., p. 121. ... 1857
Elements of Therapeutic Physics.—Dr. Hedenreich, p. 248 ... 1854
Application of Electricity. By Viscount Dumoncel, pp. 113 and 119, ed. II. 1853 to 1856
Electricity and Magnetism, by Prof. Becquerel
Guy's Hospital reports, p. 107 ...
Treatise on Electricity in Theory and Practice, De la Rive, vol. 3, p. 601 to 609, 1st ed. ... 1858
Académie de Science, Paris, extract reported in "The Cosmos" ...
Manual d'Electrothérapie, p. 85, ed. I. Tripier... 1861
Medical Electricity, Tibbits, p. 20 ... 1873
Traité Elementaire de Physique Medle. Wundt, p. 571 ... 1871
Pathology and Therapeutics, by Mr. Wunderlich, vol. I., p. 113 ...
Effects of the Electric Bath, Gazette des Hopitaux, Paris ...
Popular natural philosophy, Ganot, p. 731, ed. 7 1872
Phenomène de la Nature, Valerius, p. 239, vol. I. 1858
L'Electricité appliqué à la Therapeutique Chirurgicale ... 1870
L'Electro-therapie dans les Maladies Genital et Urinaire, par le Dr. Delaume ... 1872
Practice of Medical Electricity. Powell, p. 20 1872
L'Electricité appliquée au traitement des Maladies, par Dr. Desparquets ... 1862
Medical Surgical Electricity. Drs. Beard and Rockwell, p. 137, ed. I. ... 1871
Guide pratique du Doreur. Roseleur, p. 88, ed. II 1866
Med. Use of Electricity. Garratt, p. 117, ed. II. 1861
Althaus, p. 302 & 303, ed. II. ... 1870
De l'Electricité de l'Action des eaux Minérales. Scoutetten ... 1864
Compendium, p. 231 & 232, ed. III. ... 1866
Lancet, vol. II., xvii., 1851 & No. I. vol. II.... 1859
Electricity, Magnetism, and Acoustics. Lardner & Foster, p. 304... ... 1866

The Inventors' Institute.

At the meeting on Thursday, the 13th of March, 1873, Dr. R. H. Collyer, F.C.S., in the chair, Mr. R. M. Latham, the secretary, reported that the special committee appointed to consider and report upon the statements and recommendations contained in the report of the Select Committee of the House of Commons on letters patent, had held a number of meetings, and considered many of the points referred to in that report; however, the special committee had not yet drawn up a definite report, but hoped it would be able to do so shortly. He could state that that committee dissented from most of the recommendations put forth by the House of Commons Committee, and he might say that every effort would be made to have the report of the special committee ready for presentation at the next meeting of the institute. Mr. Latham also stated that since the last meeting he had learnt that a Bill was in preparation, embodying most of the recommendations of the House of Commons Committee, and he urged the meeting to deal with it at once, as otherwise it might be placed before the Legislature, and accepted as being tacitly sanctioned by inventors at large. After some remarks from the CHAIRMAN, Mr. CAMPIN, and Mr. C. G. CARTTAR, the following resolution was unanimously agreed to and ordered to be published "That the secretary be directed to convey to her Majesty's Law Officers the unqualified disapproval of the Inventors' Institute of any legislative action being taken based on the recommendation of the Select Committee of the House of Commons appointed to report on the Patent Laws, and expresses a hope that a more complete inquiry, either by Royal Commission, or otherwise, will be instituted into the whole subject, especially as regards the interests of working men and the poorer class of inventors, whose views and interests on the question of Patent Law reform appear to have been wholly ignored, no evidence thereon having been taken by the said Committee. And it is further resolved that her Majesty's law officers be respectfully solicited to receive a deputation representing the Inventors' Institute, that the grave objections which exist as to the said recommendations may be explained in detail, and the views of inventors on the reforms which are urgently needed may be fully set forth."

At the meeting on the 15th March, 1873, Mr. C. G. Carttar, Member of Council, in the chair, the secretary reported that he had communicated with her Majesty's law officers, as requested by the resolution of the last meeting, and that the Government did not intend to bring in any Bill on the subject during the present session, it was, therefore, agreed that further proceedings on the Patent question should be adjourned till the result of the political crisis, arising upon the resignation of the Gladstone Ministry, should be known.

GEOGRAPHICAL SOCIETY OF IRELAND.

AT the annual general meeting of the Geological Society of Ireland, held in the Museum of Trinity College, the President, Prof. Macalister, M.B., read his address, and the following officers for the incoming year were elected:—President, Prof. E. Hull; Vice-Presidents, Earl of Enniskillen, Col. M. Taylor, Prof. A. Macalister, Rev. H. Lloyd, and Sir R. Griffith; Treasurers, Messrs. W. Andrews and S. Downing; Secretaries, Rev. S. Haughton and Prof. R. H. Traquair; Council, Sir R. Kane, Rev. M. Close, Messrs. A. Gages, B. B. Stoney, W. Frazer, A. Carte, W. H. S. Westropp, C. R. C. Tichborne, F. M. Jennings, J. H. Greene, W. H. Baily, W. Ogilby, R. A. Gray, J. E. Reynolds, and R. Hardman.

Proceedings of Societies.

ROYAL SOCIETY.

FEB. 13.—Rear-Admiral Richards, C.B., V.P., in the chair.—The following papers were read: "On Curvature and Orthogonal Surfaces," by Prof. Cayley; and "On a New Relation between Heat and Electricity," by Prof. Guthrie.

Feb. 20.—Rear-Admiral Richards, V.P., in the chair.—The following papers were read: "On the Anatomy and Histology of the Land Planarians of Ceylon, with some account of their habits and description of two new species, and with notes on the anatomy of some European aquatic species," by Mr. H. N. Moseley; and "On a New Locality of Amblygonite and on Montebrasite, a new hydrated aluminium and lithium phosphate," by M. A. O. Des Cloizeaux.

MATHEMATICAL SOCIETY.

FEB. 13.—Dr. Hirst, President, in the chair. —Prof. R. S. Ball and Dr. J. Hopkinson were elected members, and Prof. Greenhill was proposed for election.—The following papers were read: "On the Higher Singularities of Plane Curves," and "On Systems of Linear Congruences," by Prof H. J. Smith, and "On the Application of the Hodograph to the Solution of Problems on Projectiles," by Mr J. Macleod.—The President, Mr Roberts, V P., and Mr. Cotterill took part in discussions on the papers.

STATISTICAL SOCIETY.

FEB. 18.—Dr. Farr, President, in the chair. —The following gentlemen were elected Fellows, Messrs. R. Seyd, L. Emanuel, A. G. Browning, E. M'Dermott, R. O. Underdown, and Sir E. W. Watkins. Mr. R. H. Inglis Palgrave read a paper "On Banking in the United Kingdom." The paper included a review of the present position of banking in Great Britain and Ireland, Hamburg, Denmark, and Sweden, with an estimate of the amount of inland and foreign bills in circulation in Great Britain and Ireland.

METEOROLOGICAL SOCIETY.

FEB. 19. Dr. Tripe, President, in the chair. The following gentlemen were elected Fellows Mr. J. K. Laughton, Rev. A. Mackennal, and Dr J. Nicol. The names of seven candidates for admission into the society were announced The following papers were read "A Description of an Electrical Self-Registering Anemometer and Rain-Gauge," by the Rev. F. W. Stow. The general principle on which the registering apparatus is constructed is that of the Morse telegraph instrument as worked in America. The tape is drawn by a clock at the rate of six inches per hour, as it passes over a grooved brass roller, holes are punched in it by a sharp steel-point, drawn down by an electro-magnet whenever the electric circuit is completed, and drawn back by a spiral spring when the contact is broken. There are two grooves in the roller and two electro-magnets, one of which is worked by the anemometer and the other by the rain-gauge; thus, when both magnets are in operation, two parallel rows of holes are punched in the tape. "On the Madras Cyclone of May 2nd, 1872," by Captain H. Toynbee. After giving extracts from several logs containing data during the time of the hurricane, and observations made at the Madras Observatory, the author thinks it seems fair to conclude that the centre of this cyclone passed to the westward and probably to the northward, between the parallels of 10 deg. and 13 deg. N.; that its route was much interfered with by the high land to the west and south-west of Madras; but that it caused very disturbed weather on the west coast of India. "On the Character of the Storm of the 21st—23rd of August, 1868, over the British Isles," by Capt. T. O. Watson.

CHEMICAL SOCIETY.

FEB. 20.—Dr. Frankland, President, in the chair.—The first paper read was, "Solidification of Nitrous-Oxide," by Mr. T. Wills. The gas having been previously liquefied by compression in a strong iron vessel, can be caused to solidify by the rapid evaporation of the liquid in a current of air. It somewhat resembles solid carbonic acid in appearance. A paper "On Aurin," by Messrs. R. S. Dale and C. Schorlemmer, was read, giving an account of the author's investigation of the composition and chemical properties of this dye. "Researches on the Action of the Copper-zinc Couple on Organic bodies. I. On Iodide of the Ethyl," by Messrs J. H. Gladstone and A. Tribe, was read by Dr. Gladstone; and the last communication, "On the Determination of Ammonia in the Atmosphere," was read by the author, Mr. A. H. Smee, jun. The method employed is to collect and examine the moisture condensed from the atmosphere on the external surface of a suitable glass vessel filled with ice. The lecture was illustrted by drawings of the magnified crystalline forms which are left on evaporating the liquid.

GEOLOGICAL SOCIETY.

FEB. 21.—*Annual General Meeting.*—His Grace the Duke of Argyll, President, in the chair.—The secretary read the reports of the Council, and of the Library and Museum Committee. The general position of the society was described as satisfactory, and the number of Fellows was said to have essentially increased.—The President presented the Wollaston Gold Medal to Sir P. de Malpas Grey-Egerton, Bart.; the balance of the proceeds of the Wollaston Donation Fund to Mr. J. W. Judd, the Murchison Medal to Mr. W. Davies, of the British Museum; and to Prof. Ansted, for transmission to Prof. Oswald Heer, of Zurich, the balance of the Murchison Fund.—Prof. Ansted, having suggested that Sir C. Lyell, as a particular friend of Prof. Heer's, might very appropriately speak in his name, Sir C. Lyell referred briefly to the nature of Prof. Heer's work, and said that he was sure that gentleman would appreciate highly this renewed expression of the interest taken by the Geological Society in his pursuits.—The President then read his anniversary address, in which he discussed the phenomena of denudation, referring especially to the influence of subterranean and other movements of the crust of the earth upon the denudation of its surface, and disputing the greatness of the denuding effects of glacial action. The address was prefaced by biographical notices of deceased Fellows, including Prof. Sedgwick, Dr Kelaart, Mr. A. Smith, Mr. N. Beardmore, and Prof. Pictet.—The ballot for the Council and Officers was taken, and the following were elected for the ensuing year:—President, the Duke of Argyll; Vice-Presidents, Prof. P. M. Duncan, R. A. C. Godwin-Austen, J. Prestwich, and Prof. A. C. Ramsay; Secretaries, J. Evans and D. Forbes; Foreign Secretary, W. W. Smyth; Treasurer, J. G. Jeffreys; Council, Prof. T. D. Ansted, the Duke of Argyll, W. Carruthers, Prof. P. M. Duncan, Sir P. de M. G. Egerton, Bart., R. Etheridge, J. Evans, J. W. Flower, D. Forbes, Capt. D. Galton, R. A. C. Godwin-Austen, J. W. Hulke, J. G. Jeffreys, Sir C. Lyell, Bart., C. J. M. Meyer, J. C. Moore, J. Prestwich, Prof. A. C. Ramsay, R. H. Scott, W. W. Smyth, Prof. J. Tennant, W. Whitaker, and Rev. T. Wiltshire.

Feb. 26.—Prof. Ramsay, V.P., in the chair.—Messrs. J. H. Johnson, H. L. Philipps, and W. H. Holloway, were elected Fellows.—The following communications were read: "On the Jurassic Rocks of Skye and Raasay," by Dr. J. Bryce,—and "Observations on the more remarkable Boulders of the North-West of England and the Welsh Borders," by Mr. D. Mackintosh.

GEOGRAPHICAL SOCIETY.

FEB. 25.—Major-General Sir H. C. Rawlinson, K.C.B., in the chair. The following new Fellows were elected: The Marquis of Blandford, Gryf Jaxa Bykovski, Dr. J. Rambaut, Capt. B Lovett, Messrs. W. H. Davies, S. G. Glanville, A. Margary, F. Read, and R. Short. The paper read was "Notes on Badakshan and Wakhan," by the President. The author showed first, by aid of a wall-map, the present southern boundary of the Russian empire in this direction, the northern boundary of British India, with Afghanistan to the north-west, and the rugged country of various independent chieftains lying between the utmost northern boundary of Afghanistan and the Russian frontier. The river Oxus here has a general course from east to west, but with a large northern bend in Badakshan. We were indebted for our knowledge of the upper course of the Oxus to our own traveller, Lieut. Wood, I.N., a member of Burnes's mission, who ascended the river nearly to its source. Next to Wood, our best informants were various native surveyors, trained in the service of the Trigonometrical Survey of India, and despatched on the dangerous mission of examining the country beyond our frontier by Major Montgomerie. The principal of those were Mahomed Amin, Abdul Majid, the Pundit Manphul, Faiz Baksh, Ibrahim Khan, and the Mirza. The only part of the Upper Oxus which none of the travellers had seen was a portion of the great northern bend already mentioned. Sir Henry pointed to a map, on a large scale, on the screen, which showed the present state of our geographical knowledge of the region. He further explained that the whole region was very mountainous and rugged, rising from 800 ft. at Kunduz, to 15,600 ft. at Lake Sirikul, a distance of about 300 miles in a straight line. The river for the most part flowed at the bottom of precipitous gorges, along which it was sometimes impossible to travel. It was true that the ruby mines of Wakhan, as well as Roshnan and Shignan, lay north of the river, and so were excluded from Afghan territory by the recent arrangement, but, on the other hand, a portion of Darwaz (Begship north of the Oxus) lay to the south of the river, so that there was a giving and taking of territory. The small mountainous states north of the Oxus had been always independent; neither the Greek kingdom of Bactria, the Sassanian monarchy, the Afghan, the Turks, nor any modern power, had been able to subdue them; and these states would lie between the northern frontier of Afghanistan and the Russian territory. The true geography of this region had been falsified by one of the most curious cases of literary fabrication yet made known. It had been exposed by the late Lord Strangford, and also by himself in an article in the *Edinburgh Review*, and was due to that learned orientalist, Klaproth, who fabricated, partly from Chinese maps and documents, three manuscript works, copiously illustrated by maps, purporting to give the geography of a large part of Central Asia. He invented a story of modern travel to account for each work, and contrived to sell all three at a high price to the Russian and British Governments. Col. H. Yule had recently thrown fresh light on the same singular imposture, especially that part which related to the Upper Oxus, by showing that one of the squares of a Chinese map used by Klaproth had been inverted, so that the east and west sides were made north and south; this gave the Oxus a north and south direction, and threw Wakhan more than 100 miles to the north, or close to the Russian frontier. The Russians have adhered to this false geography, and hence the mistake of Gen. Kaufmann in declaring that Wakhan (a portion of Afghanistan territory according to the new arrangement) lay near the Russian boundary. In conclusion, Sir Henry touched on the political points of the question. He believed that Russia would never consider it her interest to push her frontier up to the Oxus in this direction, and that the British Government had adopted a wise plan in fixing the course of the Oxus as the limit of Afghan territory on that side. In the discussion which followed, Lord Lawrence expressed his entire concurrence in the views developed in the paper, and entered into details of our recent relations with the Afghan Government, which went to show that it would thoroughly approve of our action with regard to the northern frontier of their country, and that it was not likely to be aggressive beyond it.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

FEB. 26. At the Council Meeting, Mr. J. R. Planché in the chair, it was announced that the Congress for the present year would be held at Sheffield, during August or the early part of September next, the Duke of Norfolk, being the President.—At the evening meeting, Mr. G. M. Hills, Treasurer, presided. Exhibitions were made by Messrs. Roberts, J. W. Baily, Leveen, Dr. Kendrick, and others, and amongst the objects was a portion of a Roman bronze eagle, presumed to belong to a standard bearer, and lately found in Victoria-street, City. Mr. Grover, in illustrating it, read a few notes "On Roman Legionary Eagles," and referred to a similar bronze eagle having been found by the Rev. Mr. Joyce, at Silchester, who, he intimated, was about to read a paper on the subject at the Society of Antiquaries very shortly. Mr. Syer Cumming, V.P., read a short paper "On Roman Water or Conduit Pipes," and illustrated it by some sections of leaden pipes, undoubtedly Roman, lately found in the city and at Beaulieu Abbey, Hants. The piece of the one found in the city was unusually large, being six inches in diameter, and had been produced at a previous meeting of the Association, by Mr. E. Roberts.—Mr. Blashill read a paper communicated by Mr. J. T. Irvine, "On Roman Temples at Bath," and Mr. Grover made some comments thereon, pointing out, amongst other matters, that there was evidence that coal had been used by the Romans for the purpose of keeping up the perpetual or sacred fires in these temples.—The Treasurer called attention to a fine specimen of the peg tankard, said to have belonged to Sir Francis Drake, of silver, and weighing 30½ oz. avoirdupoise.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

MARCH 4. Dr. Birch, F.S.A., in the chair. The following candidates were duly elected members of the society: Rev. Geo. Attwood, M.A., F.C.P.S.; Rev. J. Cunningham Geikie, D.D., John Hall Gladstone, Esq., Ph.D., F.R.S., F.R.G.S., Col. Charles Seton Guthrie, Mrs. Hamilton Gray, Rt. Hon. Lord Claud Hamilton, M.P., John Holmes, Esq., Thos. Katslake, Esq., Charles J. Lacy, Esq., Arthur Dyott Thomson, Esq., Professor Wright, LL.D. (Cambridge). The following paper was then read: "On the Synchronous History of Assyria and Babylonia, translated from the Cuneiform Inscriptions." By Rev. A. H. Sayce, M.A.—This most ancient historical document, which unfortunately exists in a very fragmentary condition, is a chronological history of the two kingdoms of Assyria and Babylonia from the fifteenth to the seventh centuries B.C.; from the time of Karaindas to that of Shalmaneser, with whose invasion of Babylonia the record ends, and whose famous black marble obelisk is now in the British Museum. Mr. Sayce accompanied his translation with numerous historical and philological comments, and promised to translate some further historical tablets on another occasion.—An interesting discussion ensued.

MICROSCOPICAL SOCIETY.

MARCH 5.—C. Brooke, Esq., President, in the chair.—Mr. E. J. Gayer contributed some further notes on the Micro-spectroscope and microscope, in continuation of his paper upon the same subject read at the December meeting of the Society.—A paper, by Dr. Maddox, "On a Minute Plant found in an Incrustation of Carbonate of Lime," was also read to the meeting, and was illustrated by carefully executed drawings, and prepared specimens exhibited under the microscope.—The Secretary stated, with reference to some crystals shown at the previous meeting, obtained from the condensed vapour of coke, that they had been examined by Mr. Bell, and found to consist chiefly of protosulphate of iron.—A new metallic chimney for microscope lamps was introduced by Mr. Wenham, its merits being explained by the Secretary, and discussed by the meeting.—Mr. E. C. Baber was elected a Fellow.

THE INSTITUTION OF CIVIL ENGINEERS.

AT the meeting of this Society on Tuesday, the 4th of March, Mr. Hawksley, President, in the chair, nineteen Candidates were balloted for and declared to be elected, including three Members, viz., Mr. John Bennett, Ex-Eng., P.W.D., Government of India; Mr. George James Hervey Glinn, Ex-Eng., P.W.D., Government of India; and Mr. Robert Harris, Engineer of the Eastern Division of the Gas Light and Coke Company.—Sixteen gentlemen were elected Associates, viz., Mr. John Barker, Westminster, Mr. Thomas Holmes Blakesley, M.A., Stud. Inst. C.E., Gray's Inn-square; Mr. Philip Carpenter, Locomotive Superintendent of the Cantagallo Railway, Brazil; Mr. Samuel Brothers Darwin, Secretary and Manager of the Shrewsbury Gas Works; Mr. Edward Giles, Offices of the Crown Agents for the Colonies, Lieut. Fred. Wm. Joseph, Ex-Eng., P.W.D. Bombay, Mr. William Henry King, Stud. Inst. C.E., Assistant Engineer, P.W.D, India; Mr. Charles Edward Nicholas, Oude and Rohilkund Railway; Mr. Francis James Odling, Stud. Inst. C.E., Devonshire-street; Mr. Arthur Ricketts, Penge, Mr. Richard Edward Speakman, Nantwich; Mr. Thomas Sullock Stooke, Water Works Engineer to the Corporation of St. Helens; Mr. George Thompson, Government Engineer and Manager, Asuncion and Villa Rica Railway, Paraguay; Colonel John Salusbury Trevor, R.E., Consulting Engineer for Railways to the Government of Bombay; Mr. John Whittingham, Surveyor to the Audlem District, Cheshire; and Mr. George Henry Wood, Buckingham-street.—It was announced that the Council, acting under the provisions of the Bye-Laws, had transferred Mr. William Francis from the class of Associate to that of Member; and had admitted the following Candidates as Students of the Institution, viz., Messrs. Augustus Marius Heaton, Thomas George Bond, Frank Ferguson, Buckham, Montague Martindale, and Edward Thompson.

ANTHROPOLOGICAL INSTITUTE.

MARCH 4.—Prof. Busk, President, in the chair. Messrs. R. B. Holt, P. Hardwicke, C. A. Howell, and E. W. Cox, serjeant-at-law, were elected Members. The following papers were read: "On the Looshais," by Dr. A. Campbell; "Flint Instruments and Pottery from Canada," by Sir D. Gibb; and "The Ventnor Flints," by Mr. H. M. Westropp.—The President described an Australian skeleton which the Institute had lately received from Dr. R. Peel, of Adelaide.—Mr. W. Topley exhibited a series of stone implements which he had taken from the surface soil in several counties of England and in France and Spain.—The President announced that in addition to the Psychological Committee which had been lately appointed, and was now in active work, others had that day been appointed, viz., for Physical Characters of Mankind, for Prisean Archæology, and for Descriptive Ethnography.

GENERAL LITERATURE.

CONTINUED FROM PAGE 8.

Plays and Puritans, and other Historical Essays. By CHARLES KINGSLEY. Macmillan & Co.

THIS volume consists of three essays from the *North British Review*, and though republications of such a kind frequently lack the freshness and interest belonging to their first appearance, this volume of Mr. Kingsley vindicates itself in every page from such a censure. There is such a vigour of style, an originality and freshness of thought, a rich picturesqueness of description, that once the book is taken up it must be read through with pleasure, and certainly not without a strong interest being excited in the characters and scenes described.

It is not easy to agree on all points with the writer; nearly every intelligent reader will demur to some of the opinions expressed; but in Mr. Kingsley's case we like him the better for this, and we respect him the more, because we feel that over and above his ability and enthusiasm, there is a respect for the reader's understanding, and a kindly sympathy with honest doubts and differences which place him and the reader from the first instant *en rapport* with each other.

The first essay, that which gives its title to the volume, treats of the character of the English drama down to the latter part of the Puritan times, and strongly sustains the objections urged by the rigidly pious. It is not hard to make out a case on the side taken by Mr. Kingsley. There can be little doubt that the dramatists, from even prior to Shakespeare, down to the days of the second Charles, are on many grounds exceedingly objectionable, and though many reasons may be alleged to account for this, little can be said that by the present age it could be taken implicitly as a justification. Shakespeare stands alone, not free from stain, if we are to fix the canons of orthodox morality, but so free from intentional offence, so far above the facts of life in his time, that we must claim for him, who, as a dramatist, had to listen to the living world and observe its doings; a frank acquittal even from the purest of our modern censors. In truth he walked in the neighbourhood of the gods and listened to their "large utterances;" he had also listened to the minute melodies of the tiny fairy people who danced their "light fantastic rounds" on the young grass in the pale Athenian moonlight His eye and ear were divinely touched and his words, thoughts, and fancies to us are beyond all criticism. We wonder at them and love them, and no mere human reproach can destroy, or even lessen, that wonder and love.

On the other hand, anybody, who will, may say their say about Beaumont and Fletcher, Jonson, Webster, Massinger, Marston, Middleton, Ford, or any other of the great writers who so swarmed in that glorious age that we have in the multitude of their wonderful productions forgotten as much as would have made the literary reputation of any other nation. It is true many of these were coarse and offensive to modern taste, but it should not be forgotten that these men were not "divine," like their great contemporary. They wrote *of* living men and women *for* living men and women; they dealt with the world's vices and the wicked thoughts of men and women in a rather too open and straightforward manner; but nevertheless redeemed by wonderful beauty of thought and language, often elevated by a vigorous and refined imagination. Nevertheless, they were so degraded by a tampering with passions and vices in a vulgar and worldly way, that they offered a sufficiently wide mark for the shafts of the reformers of the day which as frequently were shot by the bigot and hypocrite as by the honest man anxious to preserve the morals of the public from the corruptions of the stage.

And this was so in all things—seriousness and honesty are nearly always attended by sourness and pretence. In religion it was not sufficient—as Lucy Hutchinson informs us in the life of her husband—that we should conform in doctrine, and in the fashion of comparatively short hair, but he was accused openly of want of true piety, because he objected to cutting his locks to a Vandyke pattern, which was one of the extreme follies of enthusiastic reforming Puritans. Still it must be admitted that the Puritans have been grossly misrepresented. Butler, Lestrange, and others have marked them with ridicule, and brought upon their memories an undeserved contempt, from which Mr. Kingsley labours very zealously and very effectually to free them. No doubt the portrait he had sketched, with a few necessary harsh but requisite touches left out, is as correct as it is vivid and life-like. What can be better than the following —

"Was there no poetry in these Puritans, because they wrote no poetry? We do not mean now the unwritten tragedy of the battle-psalm and the charge, but simple idyllic and quiet home drama, love-poetry of the heart and the hearth, and the beauties of every-day human life? Take the most common place of them. Was Zeal-for-Truth Thoresby, of Thoresby-rise, in Deeping Fen, because his father had thought fit to give him an ugly and silly name, the less of a noble lad? Did his name prevent his being six foot high? Were his shoulders the less broad for it, his cheeks the less ruddy for it? He wore his Saxon hair of the same length that every one now wears theirs, instead of letting it hang half-way to his waist in essenced curls; but was he, therefore, the less of a true Viking's son, bold-hearted as his sea roving ancestors who won the Danelagh by Canute's side, and settled there on Thoresby rise to grow wheat and breed horses, generation succeeding generation in the old moated grange? He carried a Bible in his jack-boot, but did that prevent him as Oliver rode past with an approving smile, on Naseby-field, thinking himself a very handsome fellow, with his moustache and imperial, and bright red coat, and cuirass well polished, in spite of many a dint, as he sat on his father's great black horse as gracefully and firmly as any long-locked and essenced Cavalier in front of him? Or did it prevent him thinking, too, for a moment, with a throb of the heart, that sweet cousin, Patience, far away at home, could she but see him, might have the same opinion of him as he had of himself? Was he the worse for the thought? He was certainly not the worse for checking it the next instant, with manly shame for letting such "carnal vanities" rise in his heart, while he was doing the Lord's work in the teeth of death and hell; but was there no poetry in him then? no poetry in him, five minutes after, as the long rapier swung round his head, redder and redder at every sweep? We are befooled by names, call him Crusader instead of Roundhead and he seems at once (granting him only sincerity, which he had, and that of a right awful kind), as complete a knight-errant as ever watched and prayed, ere putting on his spurs, in fantastic Gothic chapel, beneath storeyed windows richly dight. Was there *no* poetry in him, either, half an hour afterwards, as he lay bleeding across the corpse of the gallant horse, waiting for his turn with the surgeon, and fumbled for the Bible in his boot, and tried to learn a psalm, and thought of Cousin Patience, and his father, and his mother, and how they would hear, at least, that he had played the man in Israel that day, and resisted unto blood, striving against sin and the man of sin?" This is worth reading, and there is much more in this excellent volume with which the reader will be pleased to make acquaintance. The second essay on "Sir Walter Raleigh and his Time," as well as the other on "Froude's History of England," require careful reading. In a very interesting and life-like way, the Devonshire hero is brought before the eye, and his wonderful adventures, struggles, triumphs, shames, and death recorded; and very ably, by careful and exciting narration, are we brought by Mr. Kingsley to take an interest in the man and his times. But for this, as well as what is said of Mr. Froude and his History, we have to refer our readers to the volume itself, which we feel certain will be perused with great interest and pleasure, and most assuredly not without the advantage of an increased sympathy with the times and people treated of. No doubt, of old "Bluff King Hal" and his doings, we have had very incorrect ideas. He clearly was not quite an ogre, though it is very hard to believe in him with patient tolerance. However, in such a case, it is better to hear both sides, and in that spirit of fairness which counsels this, we recommend to our readers what Mr. Kingsley, in defence of Mr. Froude, has thought it fitting to say.

Hymns of Modern Man. By THOMAS HERBERT NOYES, Jun., of Ch. Ch., Oxford, B.A. Author of "Idyll of the Weald," "Lyrics and Bucolics," &c. London: Longman, Green, and Co. 8vo., pp. 70.

THIS is an age of enquiry an age of upheaval of ancient landmarks, and we find that even the ancient strongholds of orthodoxy send out bold thinkers who assert their hereditary right to advocate reforms from within the precincts of the sanctuary. They belong to the class of minds which rebel against the crystallization of dogma which has taken place during the last three centuries, and sigh for a new Reformation to supplement its predecessor, and extend the basis of the National Church on the principles of a catholicity which would repudiate the prejudices of sectarianism. This little book is a good sample of the Broad School of thought. The author is evidently one who gives full swing to his intellectual powers, and would fain give a reason for the faith that is in him, it is fair to say that he manifests no affection for the Athanasian Creed.

The poems consist of a prelude in the nature of an Eirenicon, and a series of seven thoughtful didactic poems in easy anapæstic metre, entitled "The Philosopher's Stone," "Who is He?" "The Lukewarm," "The Religion of Love," "Mother Church," "What is Truth?" and "The New Revelation," followed by hymns in various metres, and a version of the Lord's Prayer, which, space permitting, we should have been glad to quote at length. We will, however, select one or two average samples of the author's style.

The first, from the "Philosopher's Stone:

> *Some religion is not speculation*
> *On mysteries hidden from view,*
> *It consists in no food affirmation*
> *Of doctrines and dogmas as true.*
> *It consists in the practice and science*
> *Of duty to God and to man*
> *If mankind be the Deity's clients*
> *We serve Him in serving His clan.*

> It were folly to trust Revelation
> Which flinched from the touch stone of truth,
> We could feel not the least hesitation
> In drawing Imposture's last tooth.
> We would tear off the veil from her features,
> And peel off the paint from her face,
> Though she seemed the most gracious of creatures
> We would not be fooled by her grace.

> What of knowledge we have in possession,
> What knowledge we yet may possess,
> We would fain make the humble confession,
> Is God's gift if no more than a guess.
> For we doubt not the true inspiration
> Of intellect born on His earth,
> We would scoff at no new Revelation
> That proved its legitimate birth.

Political Portraits. Characters of Some of our Public Men. Strahan and Co.

THESE sketches are reprinted from the *Daily News*, and must have been seen by many of our readers when they appeared originally in that paper.

The subject of this volume prevents us from giving it an elaborate notice. Though it is written with great impartiality and all necessary fairness of temper, yet as the persons whose portraits are here presented to the world are all political men, it would be very difficult to refer to them here without some slight degree of political feeling, certainly without exciting the suspicion that it existed.

Still a few words should be said in praise of the author (who withholds his name, but who is believed to be Mr. Hill, the editor of the paper in which they first appeared); inasmuch as he really has avoided those touches of ill-natured depreciation and exaggeration which usually characterise the labours of those who worked before him in this unthankful field. There is not in this volume any trace of party bias or personal feeling—Whigs and Tories are treated on their merits as politicians, statesmen, and orators; and in a recognition of this spirit we follow the writer with confidence, as we know that, according to his light, he places before us, to admire or condemn, the men whose portraits he has undertaken to sketch in the light in which they appear to him, in their faults and failings, as well as in their strength and excellences.

This is much to say, especially in regard to an undertaking which is of no value at all unless it be performed fairly. For the most part the political portraits of the early part of the present century were coarsely drawn, and with a deliberate intention to distort and, therefore, to deceive. Little has been done in a spirit of fairness to give us a clear conception of our great politicians and statesmen just as they were, and hence the opinion formed by the different parties in the State as to the intellectual and moral character of party leaders are, as a rule, gross misconceptions, and as such they have perpetuated party divisions and strifes among the people which, but for them, would have died a natural death long ago.

These portraits give us—so far as we have had an opportunity of comparing them with the originals—a correct representation of the men. The mental analysis is not always as subtle as it might be, and occasionally, we think, we can detect incorrect handling; but, on the whole, the work is conscientiously, cleverly, and carefully done. No attempt is made to give the mere outside appearance of the men, which is, perhaps, a fault; but inasmuch as the mere description of features and clothing are never of any value where they do not indicate some quality of the mind, it is as well that they have been avoided. Upon the whole the book is an honest and clever book, and on these grounds we can very cordially recommend it to our readers.

PERKINS' HIGH-PRESSURE ENGINE.

A VERY interesting trial was recently made of marine engines on this novel system in the *Filya*, in the presence of his Royal Highness the Duke of Edinburgh, Admiral Lord John Hay, Admiral Houston Stewart, controller of the Navy, Mr. Wright, chief engineer of the Navy, Mr. Perkins, and Messrs. Hunt and Sacre, the managers of the Yorkshire Engine Company, by whom the steamship was fitted. The vessel left Blackwall about noon and steamed for some time on the river, the results being regarded with great favour, the engines working without a vacuum, at a consumption of 17 lb. of coal per horse power. With a vacuum, the apparatus for which will hereafter be applied, the consumption is expected to be reduced to 1½ lb. The boiler is of tubular construction, and so constructed that every set of four pipes can be detached by means of differential sockets, permitting in this way the readiest replacement in case of any accident. The tubes are four inches in diameter and half an inch in thickness, and have been pressed to 3,000 lbs. to the square inch; the steam working from 250 lbs. to 300 lbs. leaves a margin of safety of 79·80 lbs., whereas in ordinary boilers the safety limit is not more than twice the ordinary working pressure. The compactness of the boiler is an advantage; and in war ships the local limitation of any damage from shot or shell to the part injured is a point which will merit consideration in comparison with the dangers of explosion under such circumstances with the present boilers in our fleets. The engine has four cylinders—two high, of 15 inches, and two low pressure of 30 inches, all single acting, with 12-inch stroke. During the trip the average boiler pressure was 240 lbs.

LOOKER'S VENTILATING BRICKS.

MR BENJAMIN LOOKER, of Kingston-upon-Thames, thus describes this valuable invention in the specification of his patent recently filed:—

My hollow ventilating bricks are to be constructed as parallelograms, though they may be constructed in other forms if desired, but open at the ends with internal ridges or protuberances extending from end to end so as to provide grooves therein for the purpose hereafter described.

At each end of these bricks or slabs, portions of the sides are removed, or notches made so that, thereby, when two bricks or slabs are brought end to end, an opening on each side shall be constituted, so that when these bricks or slabs are laid or set in position in a line, a number of ventilating openings will be provided which may be opened and closed, or partly opened and closed by means of sliding boards or plates, which should be provided at the lower edge with small rollers to facilitate motion, and placed in the grooves formed in the tops and bottoms of the slabs or bricks (by the ridges or protuberances aforesaid), such sliding boards or plates being made with corresponding openings to those above-mentioned, in order that by bringing these last mentioned openings opposite the said openings in the line of bricks or slabs, the ventilating holes may be opened, and by withdrawing the said boards or plates from that position, the ventilating openings can be closed. Openings, if required, are made (in the sides of the bricks or slabs) of the same character and for the same purpose as above described; and in some cases, if allowed, a brick or slab of the above internal form, but without the notches or parts of the sides removed as above described are used if interposed between the others.

When these bricks or slabs are used in constructing horticultural structures, especially those known as "Lookers," a line of these bricks is placed along the base or lower part of the structure, so that, by opening and shutting the ventilating openings aforesaid, ventilation of the lower part of the structure may be provided, and by opening the top lights, or in "Looker's" structures removing the caps or ridge tiles, top ventilation will be provided.

THE NEW WOODWARDIAN PROFESSOR OF GEOLOGY.

MR. T. M'KENNY HUGHES, M.A., of Trinity College, Cambridge, who, we announced last week, has been elected to the Woodwardian Chair of Geology, is the eldest son of the Bishop of St. Asaph. He took his degree at Cambridge in 1857, and in the early part of 1860 proceeded to Rome as secretary to H.M. Consul. Imbued with a love for geology, he applied himself during his stay in Italy to the study of the subapennine formations, and of the more recent deposits of the valley of the Tiber. On his return to England he joined the Geological Survey, on which he has been engaged for the last twelve years. Working at first in the South of England he acquired a close acquaintance with the quarternary, tertiary, and parts of the secondary formations; whilst, by his subsequent labours in the Lake District, he has splendid opportunity of studying the palæozoic rocks. Of late years he has been the companion of Sir Charles Lyell in many a geological tour, both at home and abroad.—*Athenæum.*

APPLICATIONS FOR PATENTS.

[CONTINUED FROM PAGE 2.

contraction in rods, particularly applicable to railway point rods.—E. J. Hough. Ships' lifeboats.—A. Steer.—Stoves or fireplaces.—E. P. H Vaughan. Apparatus for shearing or clipping sheep, horses, and other animals (com. by A. Payne). (Complete Specification).—J. Humber and G. Haworth. Aqueous apparatus for producing vapour to promote the health of the workers, and to soften the yarn in any process from the raw material to the finished cloth.—E. Collier. Apparatus to be applied to domestic fire-places for economising fuel.—C. F. Terry and S. Cocker. Apparatus for safely and expeditiously detaching ships' boats or any other suspended weights from blocks, cranes, or similar appliances, being also applicable for detaching locomotive engines, railway or other carriages or trucks.—W. Gorham. Kilns and apparatus used in the manufacture of cement.—A. Greenwood. Apparatus for feeding machinery employed in the manufacture of percussion caps, cartridge cases ferules, and other analogous articles (com).—M. Henry. Sugar (com. by A. Payne).

On February 22nd.—668 to 683.—E. Densmore and C H. Farnham. Type-writing machine.—J Pilkington Fire-waggons employed in the heating of bakers' ovens.—W. Tongue. Machinery for combing fibrous materials.—T. Blundell, G. T. Blundell, and J. W. Blundell. Lavatories.—F. Deakin. Puddling furnaces.—J. Robinson and J Smith Machinery for saving wood.—J. Nasmith. Machinery for preparing cotton and other fibrous materials for spinning.—R. Worthington Means or apparatus for gathering and tying up crops in sheaves.—J. T. H. Richardson Apparatus or means to be employed in the manufacture of tumblers, goblets, and other articles from glass.—W. Corbitt. Stove grates.—H. F. Durnford. Horseshoes.—M Macdermott Perforating rock, coal, slate, and other mineral substances.—J. Hargreaves and T. Robinson. Sulphate of soda and sulphate of potassa.—G. Haseltine. Mode of using steam for producing perfect combustion of fuel and consuming the smoke and inflammable gases from the same (com. by B. F. Mason). (Complete specification.)—A. M Clark. Purification of syrups and sugar (com. by L. J. F. Margueritte).—J. P. Ward. Apparatus for sifting cinders and other substances.

On February 24th.—684 to 695.—S. Rowbotham and O Richardson. Composition of artificial marbles, stones, and cements of every kind, in making them firmer, harder, less absorbent, and more able to bear exposure to air, water, and other influences hitherto.—J. Cleaver. Metallic needle case.—F. J. Bolton and C. E. Webber. Obtaining photometric measurements and apparatus for that purpose.—W. M. Brown. Carding woollen and cotton tissues and machinery for that purpose (com. by L. Giacomini.)—A. Wharton and T. Lister. Means and apparatus for raising liquids.—E. Smith and W. Brierley. Water gauges for steam boilers, and in arrangements for discharging air from boilers, pipes, and other vessels connected therewith.—J. Horrocks. Boiling, scouring, or cleansing of textile fabrics and materials, and apparatus therefor.—G. Rydill. Steam engines and boilers.—T. H. Watts. Apparatus for preventing the down draft and arresting the fall of soot in domestic and other chimneys, which invention is also applicable for obviating the back draft in ventilators.—J. Leeming. Pickers used in looms for weaving.—H. Ziegler. Carriage lamps (com. by E. Dubakin.)—J. A. Lee. Boiling wood or other fibrous material for the manufacture of paper, and the treatment of the waste leys.

On February 25th.—696 to 706.—F. Tommasi. Apparatus for generating force, especially applicable for increasing the efficiency of hydraulic presses, to render the same applicable to every work, and especially to the navigation and to railways.—S. Martin. Construction of moulds for casting ingots.—W. M. Lightbody.

Brakes applicable to carriages, wagons, or other vehicles, which are used on railways, tramways, or common roadways, the same being also applicable for other purposes.—H. J. Griswold. Apparatus to be attached to a sewing machine for embroidering, ruffling, tucking, hemming, and other like purposes.—F. T. Hughes. Mixture or combination of fluids to be employed as a circulating medium in pipes used for warming and heating purposes (com. by L. Grimm and A. J. Corvin.—J. Liebert. Mixture of ground substances to be used as a substitute for coffee, and in the apparatus employed in the preparation thereof.—A. R. Stocker. Caps and stopper, and certain other articles to be employed with bottles and other vessels, and the manufacture thereof, part of which improvements are applicable to other purposes — A. M. Clark. Manufacture of candles, matches, and other like articles, together with a lamp or apparatus for burning such candles (com. by W. J. Samuel).—T. Chappell Manufacture of gas.—J. Fawcett. Peat.—A. V. Newton. Electric clocks (com. by F. Mildé and L. C. Vimard).

On February 26th.—707 to 723.—K. L. H. Gercke. New breech-loading needle-gun, with a double-action lever mechanism, the breech moveable by a backward and downward motion, and tightly closing the barrel behind the cartridge by a well-fitting short plug —J. Robertson. Generating and applying heat —W. H. Thomas. Production of cold, and apparatus for the same, applicable for preserving animal food, and other purposes (com. by D. Postle).—E. M. and F. N. C. Vuibert. Preserving meat. —M. Shepherd. Apparatus for economising fuel for domestic or other purposes —T. Hoey. Arrangements or apparatus for preventing waste of water in connection with water-closets, and for facilitating the utilization of excremental matters, and their exclusion from ordinary drains —J. R. Barlow and R. Walsh. Apparatus for distributing water for extinguishing fire and for other purposes —R. Lancaster and I. Swindells. Steam boiler and other furnaces. G. Spencer, C.E., and W. M. Smith. Fire-boxes of locomotive and other tubular boilers. —F. J. Talbot. Machinery for bending and punching metal plates —J. H. Ivory, C.E. Treating "Val de-Travers" rock, and other like mineral substances, for the purpose of reducing the same to powder, and machinery or apparatus employed for that purpose —J. Mitchell. Manufacture of knives for harvesting and chaff-cutting machines.—W. R. Lake. Apparatus for regulating the blast of locomotive engines (com. by C B. Knowles and J. E. Saunders) —J. Brasseur and F. Wegler. Process of smoothing looking glasses and other glasses, which system is also applicable to crystal, porphyry, and other like materials —J. H. Johnson. Apparatus or means for preventing the entrance of dust into railway carriages (com. by J. Welby).—W. H. Davey. Starching and washing machine.—R. Stone. Means of manufacturing artificial fuel, bricks, and other similar compressed articles, and the apparatus employed therefor.

On February 27th.—724 to 737.—George Bray. Apparatus for cleaning or clearing the trams or rails of tramways.—W. L. Wise. Apparatus for cutting internal screw threads (com. by J. M. Fethries).—C. Brakell. Machinery and apparatus for exhausting, discharging, and transmitting air, water, or other fluids.—W. R. Lake. Roller journal boxes (com. by S. W. Wilson). —A. E. Webb. Candles and night-lights, and in the treatment of materials therefore.—J. Glover. Parts of dry gas meters.—W. Johnson. Grate and special method of supplying air to the fire, and heating boilers.—J. Nicholson and T. B. Nicholson. Railway buffers.—J. G. Redman. Compositions for preventing the corrosion and the fouling of ships' bottoms or other submerged structures.—J. H. Johnson. Machinery or apparatus to be employed in ginning cotton (com. by G. Purvis).—T. A. Edison. Circuits and instruments for chemical telegraphs.—R. Jakes. Construction of reverberating furnaces or cupolas, and the processes connected therewith for the purposes of smelting.—S. Musters. Means and apparatus for cooling beers and other liquids.

On February 28th.—738 to 747.—E. A. Leigh. Carding engines for carding wool, silk, or other fibrous substances.—J. Thornalley. Portable combined brick and tile making machines.—C. A. McEvoy. Electric fuses.—G. W. Hart. Open fire-grates.—W. Botwood. carriages.—R. K. Whitehead. Manufacture of size.—T. Cadett. Artificial fuel. — W. J. Engledue. Drying peat, manufactured or otherwise, and artificial fuel, applicable also to the drying of "kaolin" or china clay, and other like substances. — W. Tasker. Ploughs. — T. Green. Apparatus for heating feed water, applicable to steam boilers and other purposes.

On March 1st.—748 to 762.—R. Bickerton and R. Bickerton. Reaping and mowing machines.—W. R. Warner. Automatic or continuous brake apparatus for railway and other carriages, to be called "Hersiger's" automatic brake (com. by J. Hirsiger).— W. A. Ross. Method of syruping aërated fluids, and the apparatus for bottling same.—J. Maclagan. Fire-places or stoves.—J. Buchanan. Utilising alkali waste. —J. Worth. Manufacture of washers and washer cloths used in machinery for preparing and spinning cotton and other fibrous materials —G. A. Gillett Preparing or finishing leather used for covering rollers employed in machinery for preparing and spinning cotton and other fibrous materials.—G. H. Smith. Apparatus for printing on paper, linen, parchment, wood, stone, glass, metal, or other suitable material.—J. E. Barraclough. Kitchen ranges or fire-places, ovens, and boilers.—W. R. Lake. Railway carriage springs (com. by H. Gardiner). J. C. A. Henderson. Treatment of peat and apparatus therefor, part of which is applicable to other purposes —G. Smith Kilns or ovens for firing, burning, and drying bricks, tiles, pipes, quarries, terra cotta, malt, clay, and similar materials, and floors or sheds for drying the same. G. G Caprell New or improved gilding or bronzing material suitable for lithographic printing, stamping, and other also ornamenting in gilt or bronze—G K Winter, F R A S. Electric telegraphs.—F. G. Fleury Water meters or apparatus for measuring the flow of liquids.

On March 3rd.—763 to 769.—W. Fawcett. Fuel economizer and heating or stoving apparatus.—J. Hargreaves. Manufacture of soda and potassa. —S. Russell Stoppering bottles.—E Hunt. Dyeing and fixing of what are known as aniline colours.—G. Simpson. Machinery and arrangements for cutting or getting minerals.—W. Parlby. Construction and manipulation of apparatus used in the manufacture of gas —F. Curtis. Paper-pulp engines (com. by S L. Goold) (Complete Specification).

On March 4th —770 to 785 —F J. Reeves Washing linen or woollen fabrics and roots—J Oldknow. Manufacture of fabrics in twist lace machinery —T N. Palmer. Ventilator for railway carriages (com by R. Hitchcock). —P. T. Woodruff. Manufacture of annealing pots and saucers J B. Spence Generation of steam, in economizing the heat contained in waste steam, and in apparatus connected therewith R. W Thomson. Connected with elastic wheel tires.—J Long, A. Forsyth, and J R. Griffiths Obtaining artistic results in finishing photographic portraits.—J. Arnold Cannical and other thermometers.—E J. C Welch. Construction of telegraph posts, the same being applicable also to fencing posts and other purposes.—G. Haseltine Holders for pencils, crayons, and similar articles (com. by W. H. W. Campbell).—J Humblet and G. Davies Dies or moulds of machines used for manufacturing bricks, tiles, pipes, and other like articles.—R. Hodges Improvements in the manufacture of butt hinges —T G Tolson. Apparatus for saving life and property at sea.—E. Hunt and G. M. Hopwood. In treating catechus, cutch, or gambier, to obtain products therefrom suitable for use in tanning, dyeing, and printing.—A. Strauss. Mouthpieces for cigarettes, and tubes or cases with mouth-pieces for cigarettes.—W. C. Barney. Electric telegraphs.

On March 5th.—786 to 807.—W. Grigg. Application of electricity to horses and cattle suffering from local, chronic, and constitutional ailments and diseases, with all necessary appendages for applying the same. (Complete Specification.)—J. Lake. Close or open fire kitchen ranges, applicable to furnaces, stationary and locomotive engines —C. Elliot. Laminating and crushing bark, and means or apparatus employed therein (com. by J. T. Stamp).—J. Swan. Obtaining motive power.—H. J. Haddan. Manufacture of envelopes (com. by F. Dangoise).—W. A. Lyttle. Tramways and the vehicles to be used therewith, which improvements are partly applicable to other purposes.—T. A. Grimston. Steam engines.—W. M. Brown. Ice-making machines (com. by F. Littmann).—J. Taylor. Steam Generators.—W R. Lake. Manufacture of coloured or ornamented paper with cloth and other similar materials, and processes, and compounds employed therefor (com. by F. Heck). —J T. Chappell. Domestic fire-places.—T. H Rushton, and T. S. Morris, and W. I. Bromiley. Machinery for preparing, spinning, and doubling cotton and other fibrous substances. —J. C. Tiffany. Means or apparatus for manufacturing and storing illuminating gas (Complete specification).—R. Hunt. Extraction of iodine (com. by A. F. C. Reynoso).—F. Kinder Washing machines.—J. MacCunn. Steering indicators for steam and other vessels.—T. Brown. Manufacture of glass mirrors, and preparing glass for the purpose, also engraving on glass (com. by E. Dode).—W. Mickle. Smelting and puddling iron (complete specification).—T. J Smith. Kilns for burning chalk and other materials from which lime or cements are made in appliances for preventing the choking, and means for distributing the heat therein (com. by P. F. Maville).—S. Taylor Constructing and fixing sheet-metal roofing.—G Haseltine.—Improved lamp (com. by T. H. White and E. Knight). (Complete Specification).—W. L. Wise. Portable other-gas apparatus, with injector and self-regulating gasoline injection (com. by H. Juengling).

On March 6th.—808 to 821.—J. Ross. Special hygenique and economical system, by which smoke in chimneys is avoided and economy of fuel produced.—L. O Durruthy and H. P. Lassagaray Treatment of blood for the manufacture of manure.—H. E. Skinner. Machinery or apparatus for the purpose of preventing accidents upon railways, which said invention is intended to be placed within the control of railway station officials or otherwise, and out of the control of the engine-driver.—F. B. Houghton. System or means and appliances for facilitating the boiling or treatment, and the discharge of stuff and pulp to be used for the manufacture of paper.—W. England and J. England. Fuel economizers - H. Kettle. Tenoning, rebating, and spout-cutting machines.—J Wakefield. Lamps F. Jaques. Manufacture of, and the mode of, applying trade-mark labels. - T. Allcock. Expansion governors for steam engines.—J. Rylands. Machinery for straightening, measuring, and cutting wire and rods of metal —J. Harling, W. Marsden, J. Chesterman, W. Chesterman, and C. Guy. Machinery or apparatus for spinning flax or other fibrous substances.—A. P Vassard. Manufacture of artificial fuel, and in the solidifying of coal-dust and other substances by agglomeration.—W. Baines. Apparatus for working, locking, and controlling the action of railway switches, points, and signals or signs, for the purpose of more safely controlling the traffic on railways. G. Phillips Drying and roasting malt, grain, and other substances

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APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur street, Charing Cross.

On March 7th.—822 to 831.—W. M. Brown. Machine for lasting boots and shoes (com. by J. W. Brooks). (Complete specification.)—W. Wright. Manufacture of gas for heating and illuminating purposes, and apparatus for the same, parts of which are applicable to other purposes.—W. R. Watson. Fixing the tubes of steam boilers, condensers, vacuum pans, and other vessels.—W. H. Bennett. Process of packing and preserving hams, bacon, and other cured meats (com. by J. K. Collet).—E. Worroll. Apparatus for withdrawing water from pipes heated by steam, and arrangements in connection therewith.—H. B. Barlow. Apparatus employed in the concentration of sulphuric acid (com. by N. J. Galland.—J. Hargreaves and T. Robinson. Manufacture of sulphate of soda and of potassa, and the production of chlorine.—E. L. H. Jobert, Count d'Epineuil. Con truction of apparatus and means for producing economy in the consumption of fuel.—E. R. Allfrey. Slide valves applicable to steam and other engines.—T. E. Bonnar. Washing machines.

On March 8th.—832 to 847.—G. H. Tatham. Construction of railways, rolling stock for same, and other apparatus connected therewith.—J. Gratrix. Improved apparatus for saving coals and diffusing heat.—J. Keene. Amalgam for the better imitation of silver (com. by Madame P. Baudoin).—G. H. Forbes. Combustible compound designed to be used as fuel or for making lime, to be designated "chalk coal."—J. Jobson, E. W. Jobson, and G. Jobson. Open fire-places for heating apartments or chambers.—R. W. Edwards. Imparting brilliancy to relief stamping or printing.—W. J. Mayes. Furnace bars.—G. Little and T. C. Eastwood. Combing machinery.—G. Lund. Improved cloth for umbrella covering.—J. Wadsworth. Utilizing refuse matter for the manufacture of fuel and manure.—T. Hampton. Manufacture of armour and other plates. (Complete specification.)—C. W. Harrison. Apparatus for charging or impregnating atmospheric air with the vapour of hydro-carbon liquids.—J. Burley. Infants' feeding bottles.—R. Jukes. Consuming smoke economizing fuel, and producing light, and the apparatus employed therefor. H. Skoines. Manufacture of gas and the treatment of the residues therefrom, and the combination of gases for the production of light and heat, and the apparatus employed therein.—F. Kuhlmann. Utilizations of the acid residues resulting from the manufacture of chlorine.

On March 10th.—848 to 862.—J. Reidy. Improved pick or pickaxe for excavating, mining, and other purposes.—H. Dean. Improved trap for preventing the ingress of sewer gas into houses and other buildings.—T. Loveridge. Carding buttons in series or sizes for sale, more particularly applicable for carding the description known as linen buttons.—T. Smithdale. New auxiliary screw propelling apparatus to be applied to fishing craft or other sailing vessels.—A. Fayol. Frame for parasols, umbrellas, sunshades, and other such like articles.—J. Rowley. Working of coal gas tar.—E. Galeer. Hair wash.—E. T. Hughes. Fur-coated fabrics (com. by H. Kellogg).—J. Gilmore and D. Hodgson. Gill boxes.—R. K. Jones. Apparatus to be used in discharging cargo from ships.—J. H. Mapleson. Construction of tent and arrangements of frames or fittings for the same and for other tents.—H. C. Lawton. Fire-places and flues for consuming and economizing fuel for heating and ventilating rooms and buildings.—C. T. Remmett. Coal boxes or scuttles.—W. C. Barney. Electric telegraphs. (Complete specifications.)—G. Horner and A. Dobson. Steam boilers.

On March 11th.—863 to 882.—H. Page. Manufacture of paper pulp or half stuff.—W. Woodcock. Stoves and fire places.—G. P. Dodge. Hose pipes (com. by G. McKay).—G. Gibson, W. J. Taylor, J. P. Bardsley, and R. J. Fletcher. Manufacture of felt hats or other coverings for the head.—G. Mathis. Sculpture copying apparatus.—W. Weldon. Manufacture of chlorine by means of compounds of manganese regenerated in the wet way.—J. S. Haworth. Weaving handkerchiefs.—I. Hayward. Machinery for rolling wire, rods, hoops, or other sections of metal.—C. Hore. Horse clippers.—W. Heaton and H. Giddings. Ball cocks or valves used for controlling or regulating the supply of water and other fluids.—J. C. Ramsden. Method or apparatus for securing the combustion of fuel.—B. Hunt. Machinery or apparatus for trimming or burnishing the edges of the soles and heels of boots and shoes (com. by S. H. Hodges).—T. B. Wilson. Apparatus employed in the manufacture of salt.—H. P. Holt. Steam engines and surface condensers.—W. R. Lake. Finishing the soles and heels of boots and shoes (com. by L. R. Mears).—W. Mather. Construction of steam drying cylinders.—J. M. Rigby. Drill heads for rock boring and tunnelling.—F. H. Dunnett. Construction of presses for stamping and embossing.—A. M. Clark. Graining and marbling surfaces, and the means employed therefor (com. by J. J. Callow.—H. Harrison. Apparatus for preparing peat for fuel, applicable also for crushing and working or kneading clay and other like substances.

On March 12th.—883 to 906.—W. Sadler. Propelling carriages on tramways.—W. S. Fish. Manufacture of asbestos packing for piston and valve rods, pistons, pipe joints, and other similar purposes.—W. Thomson. Blocks for hoisting and lowering weights, which may also be used for steering ships.—R. Wilson. Con

structing and arranging the winding apparatus used for raising and lowering weights in collieries and mines, and for other analogous purposes.—L. Sauret. Improved mode of advertising.—B. Rudolph. Sewing machine for uniting the selvedges of stockings and other hosiery.—J. M. Stanley. Construction of furnaces for the more completely utilising the heat generated therein.—J. E. Acklom. Railway and other carriages for the conveyance of animal and vegetable substances used for food, which improvements are also applicable to other chambers for the storing of such substances.—J. Jones. Combinations of substances or materials to be used as a substitute for coal, for obtaining heat and light, and the arrangement of the furnaces or fire-places connected therewith.—S. Lang. Construction of fire-grates for domestic use so as to economize the fuel used in the same.—G. Spencer. Pulley blocks.—R. J. Jones. Operations and apparatus for drying down waste alkaline solutions of extractive matter obtained in preparing vegetable fibrous material for use in the manufacture of paper, and in recovering therefrom the alkali for re-use, also for utilizing the vapours given off during the boiling of the vegetable material or the drying down of the said solutions.—T. Radcliffe. Improved mode of treating rooms, railway carriages, and similar places, and the apparatus used therefor.—S. B. Darwin. Means of manufacturing gas.—J. Oglesby and J. A. Jackson. Domestic fuel economizer.—J. Oldroyd, M. Oldroyd, the younger, J. Woodcock, and J. Coulter. Machinery or apparatus employed in dyeing, bleaching, scouring, and waterproofing woollen or other woven or felted fabrics.—W. J. Coogan. Machinery for boarding, softening, and graining leather.—D. Adamson. Steam boilers.—G. Wool. Construction of furnace or kiln, and the means and apparatus for the application of gas for heating such furnace or kiln, and also for heating purposes generally.—F. B. Houghton. Means of, and apparatus for, filtering or separating water from earthy bodies, from which cements and similar bodies are made.—S. Warne. Manufacture of woollen fabrics (partly com. by R. Pinti).—L. Strange. Baling cotton and other materials (partly com. by J. A. Cameron and J. Frier).—D. W. Fish. Hand stamps.—G. Smith. Machinery or apparatus for obtaining motive-power, parts of which improvements are applicable to the raising, forcing, and measuring of fluids, and to the reduction of friction in bearings.

On March 13th.—907 to 925.—A. Tylor. Apparatus and arrangements for measuring water, and regulating, controlling, and arresting the water supply of water-closets, baths, lavatories, and urinals, for domestic and other use, and preventing waste.—J. T. Griffin. Carpet or power looms, parts of which are applicable to other looms in which carpets or similar fabrics are woven (com. by H. M. Babbett, C. W. Miles, and P. Hickey).—J. C. Edington. Mode of preventing vessels from sinking, and of raising sunken vessels.—F. H. Stubbs and G. H. Cottam. Coal-cutting machines.—S. Alley. Springs.—R. S. Symington. Apparatus for dealing with sewage, and other refuse or waste, so as to lessen the pollution of rivers.—M. Baerlein. Apparatus for drying yarn to be used in connection with sizing and other machines.—H. A. Bonneville. Regulator or governor for adjusting the speed or rotary motion of steam engines (com. by E. Schenck, Baronet, and W. Maurer).—W. McEwen, M.D., J.P. Instrument to render tender and disintegrate the tissue of meat before cooking.—C. Moseley. Apparatus for condensing the vapours of naphtha.—J. Baladin and T. Osborne. Manufacture of knitted fabrics.—N. J. Suckling. Chaff cutting machines.—A. Wallis and C. J. Steevens. Means and apparatus for protecting feed water-heaters against the effects of frost.—T. Black. Equilibrium berths or cabins for navigable vessels.—W. Mickle. Fuel, and economising fuel used in the boiler furnaces of the engines of screw and other steam ships, and of locomotive or railway or other engines for raising steam, and other steam boiler furnaces. (Complete specification.)—H. T. Christie. Apparatus for saving life at sea.—J. Head. Steam engines and generators.—W. S. Fish. Non-conducting covering applicable for steam boilers and engines, which may also be used for preventing the radiation of heat generally.—D. C. Miller. [illegible] evaporating, concentrating, agitating, treating liquids, part or parts of which are also applicable for granulating or crystallising materials in solution or mixed liquids.

On March 14th.—926 to 946.—E. A. L. Roberts. Treating explosive compounds to impart safety thereto for blasting and other purposes.—A. Greenwood. Drawing and spinning frames.—C. M. White. Stoppers for bottles and other articles.—J. Drew. Improved compendium or receptacle applicable to various useful purposes.—J. R. Francis. Process and machinery for separating magnetic from non-magnetic substances, and especially magnetic oxyd of iron from all foreign material (com. by F. A. H. la Rue).—E. Bevan and T. Drew. Treatment of vegetable substances to obtain paper pulp and fibres.—G. Haseltine. Mode of, and apparatus for, casting steel (com. by W. Dougherty). (Complete specification.)—W. R. Lake. Rotary pumps for lifting and forcing water (com. by S. West and L. Goodwin).—W. Hounsell. Manufacture of copper tubes.—S. Corbett. Ploughs, and attaching rotating forks or pulverizers to ploughs.—J. Pumphrey. Sifters or screens for sifting or screening cinders and for other like purposes.—G. F. Deacon. Apparatus for measuring the flow of water in pipes.—E. T. Hughes. Manufacture of the salts, carbonates, and hydrates of baryta and strontia, and also for improved modes of making baryta and strontia caustic (com. by L. G. G. Daudenart and E. Verbert.—E. T. Hughes. Treatment of greasy and washing liquors used in scouring or cleaning wool by caustic baryta or strontia (com. by L. G. G. Daudenart and E. Verbert.—C. H. Malcham and F. Mirfin. Breech-loading snap action fire-arms.—J. Holmes and J. Holmes. Shuttles for weaving.—T. Harris. Appliances for attaching lines to sliding sashes of windows, and the pulleys employed therewith.—M. Eustace. Cultivation of green crops by the use of a machine for the spacing of same, termed "green crop spacing" machine.—W. R. Lake. Manufacture of mosaic veneers or tiles, and apparatus therefor (com. by H. F. Kruse.—A. M. Clark. Treatment of peat for fuel, and apparatus for the same (com. by J. F. F. Challeton).—R. M. Melhuish. Machine for sewing button-holes, and for fancy stitching.

On March 15th.—947 to 971.—Construction of straw elevators, and an improved method or means of driving or actuating the same.—R. Mills. Gas furnaces.—C. Midgley. Fire-grates adapted more particularly for domestic purposes.—W. Crighton, W. W. Crighton, and S. Crighton. Methods of, and apparatus for, controlling the formation of the lap in lap-machines and other analogous machines.—B. Smith, J. Stake, R. Tolson, M. Firth, and C. Bradley. Apparatus for the combing of wool and other fibres.—B. Noble and J. Armitage. Means and apparatus for cleaning yarn.—E. Hollis. Mode of attaching and detaching certain parts of the stocks of breech-loading and other sporting guns.—R. Paterson. Collapsable casks or vessels for containing fermentable or aerated beverages.—J. T. Wibberley. Machinery or apparatus for winding cotton, silk, wool, or other threads on spools or reels.—W. A. Lyttle. Permanent way of railways.—J. Robey and G. F. Chantrell. New or improved filtering and deodorising medium.—L. Simon. Rotary printing machine (com. by Bullock Printing Machine Company.—W. A. Gilbee. Stopper for bottles and other vessels (com. by J. L. Megret).—T. A. Weston. Apparatus for transmitting, regulating, and arresting motion in machinery.—W. Ramsden and J. Ramsden. Machinery for twisting and doubling yarn or threads.—J. Dunn, Jun. Apparatus to be used in connection with stoves for the purpose of economising fuel.—H. Gardner. Apparatus and means for utilising spirituous substances and oils for the purposes of producing artificial light and heat.—J. Wright. Means or apparatus employed in the consumption of smoke and for economising fuel.—J. Mowbray. Means or apparatus for preventing loss of life or other accidents in coal or other shafts.—H. J. Haight. Artists' scrapers. (Complete specification.)—G. Haseltine. Pump pistons and valves (com. by I. K. Harwood). (Complete specification.)—J. Adams and B. Jenkins. Engines operated by heated air and steam combined.—W. H. Shepherd and J. Scott. Machinery for combing wool and other fibres.—G. Robey, E. Banks, and T. Forrester. Construction of kilns or ovens for firing bricks, earthenware, china, pottery, and such like substances (partly com. by De Bettignies Bros.)—S. Hall. Machinery for moulding and compressing blocks of fuel, peat, clay, and other like substances.

On March 17th.—972 to 989.—J. Burton. Invention of an improvement in or connected with pianofortes.—J. G. Tongue. Stopping motions or apparatus applicable to knitting, and other machinery (com. by G. F. Lufbery.—W. R. Watson and R. A. Robertson. Filtering liquids, and the machinery or apparatus employed therefor, being more especially adapted for filtering saccharine solutions.—W. E. Debenham. Apparatus to be employed for raising or lowering submerged vessels or other bodies.—J. Barling. Fire-grates and stoves.—W. S. Crondace. Dumb compasses, and apparatus connected therewith, such apparatus being applicable to other purposes.—S. Haley. Construction of stoves and fire-grates for economising fuel.—J. Ruston. Steam boiler furnaces, mainly applicable for agricultural and portable engines. G. T. Bousfield. Manufacture of cheese (com. by H. O. Freeman). (Complete specification).—G. Rowe. Weaving ornamental fabrics.—R. C. Sayer. Apparatus for coupling and uncoupling railway trucks and carriages.—Rev. H. R. Hawers. Ecclesiastical decorations for screens and other parts of cathedrals and churches, applicable also to public and private buildings.—J. Strickland. Manufacture of railway and other wheels, and machinery and furnaces used in the said manufacture.—H. Gardner. Means and appliances for the heating of boilers and other similar vessels.—H. W. Cook. Locomotive engines and the mode of and apparatus for condensing steam in such or other engines.—L. F. Raimond. Improved box or case containing several commercial articles.—J. Thurlow. Self-acting mules for spinning.—E. Thornton. Cooking apparatus or kitchen ranges.

On March 18th.—990 to 1001.—A. Barclay. Manufacture of pig iron and furnaces or apparatus employed therefor.—G. B. Cooper. Stoves and fire-places.—J. E. Standfield. Carriages.—J. D. Merriman. Apparatus for lighting and extinguishing public and other lights.—W. Hull. Suspending, driving, and balancing horizontal millstones.—H. F. Gough. Printing and the means therefor.—E. Dean. Making ships' boats and rafts buoyant.—J. Burton and H. Smith. Manufacture of net or lace in twist lace machines.—E. Hare and J. O. Ardron. Rotary screens for dressing and separating grain and seeds.—A. M. Clark. Peat machines (com. by C. Luxton).—C. H. O. H. d'Arros. Electro running wheel engine.—J. H. Johnson. Laying pipes across rivers, creeks, lakes, and other pieces of water (com. by J. F. Ward).

On March 19th.—1002 to 1028.—J. Perrier. Glass gas chimney, capable of resisting any degree of heat without bursting.—W. H. Goodchild and S. F. Hay. Joiners' clamps.—T. B. Coddington. Manufacture of materials, such as blocks, slabs, pillars, tubes, and such like, suitable for building and for other purposes (com. by G. De Whitt and J. Fairman).—T. Moy and R. E. Shill. Fitting water tubes, applicable to steam boilers and engines.—J. T. Woods and C. Baron de Malortie. Furnaces for economizing heat and burning inferior fuel.—G. Newton. Improved lubricant.—J. Farmer and J. B. Hamilton. Construction of musical instruments.—G. C. T. Bartley. Fire-places.—R. J. Fremlin. Purifying fusty and otherwise impure casks, and in seasoning new casks and timber to be made into casks.—E. Turner. Manufacture of packing for glands.—A. Jaynor. Construction of automatic telegraphs, to be worked by air, steam, or gas.—J. Grimes. Machinery or apparatus employed in the preparation or manufacture of the heels of boots or shoes.—J. B. Fell and G. N. Fell. Construction of light railways.—W. H. Hacking and T. Hacking. Machinery for plaiting or folding and measuring woven fabrics.—N. Whitley, H. Hoyle, and J. Haigh. Card setting machines.—E. T. Hughes. Curtain fixtures (com. by C. Buckley and L. L. Sawyer).—R. Toone, H. Z. Archer, and E. Hartshorn. Manufacture of lace in twist lace machines.—J. B. Winslow. Wire pegs for boots and shoes, and in machines for using the same. (Complete specification).—Rev. T. Wolstencroft. Warming dwelling-houses and other buildings, economizing fuel, burning slack, reducing the bulk of the refuse, improving draughts, and curing smoky chim-

(CONTINUED ON PAGE 14.)

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Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE.

MAY 1, 1873.

THE COMING PATENT LAW BILL.

Again the alarm is sounded! Again inventors are bidden to prepare for battle! The present Lord Chancellor, Lord Selborne (who, under his former name of Sir Roundell Palmer, was well known as a determined opponent of any system of Patent Law, or legal protection for invention), has undertaken to bring a Bill before the House of Lords, dealing with this branch of the law. What is the exact nature of the Lord Chancellor's legislative proposals we are not in a position to state. They may be very judicious and appropriate, such as everybody would be justified in expecting as emanating from so high an authority and from a man so esteemed for his learning and rectitude; or, they may be—as we fear they will be found to be—the definite and determinate expressions of that hostility to the claims of inventors, wherein his lordship has already proved himself to be a doughty champion. And in this aspect every watchful advocate of the inventor's cause must view the matter,—in order that they may obtain a successful peace, they must at once prepare for war.

Viewing affairs in this way, we are much pleased to find that the Inventors' Institute is taking steps to combat the enemy, its Council being in communication with several Members of Parliament, with the view to concert measures for dealing with the Lord Chancellor's propositions when they come before the Legislature.

We trust that in this matter there will be no half-heartedness—no attempt to give a sop to Cerberus, for we feel sure that any such attempt will prove a failure, as it will only result in rendering Cerberus more lively and vicious. The whole question is one of justice and public policy—justice, because whoever exerts himself in matters of honest industry is entitled to remuneration for his work; public policy, because it is a wise and reasonable thing to use every means calculated to promote the growth and practical development of new inventions; and as in the walks of ordinary, and, so to speak, imitative industry, so in this extraordinary path of originative industry—invention—there is in the present constitution of society no other reliable method of promoting progress than that of assuring to every man his fair chance of remuneration for his industrial exertions.

The best course for those who champion the inventor's cause is for them to insist upon the justice of his claims to the security of a special property in his inventions, which can only be satisfactorily effected by showing that it is not the mere utterance of bare suggestions of the possibility of effecting certain industrial improvements that constitute what is termed invention, but utterance combined with practical demonstration; for it may possibly be true that there is not much due to those who content themselves with putting forth mere suggestions, beyond what may be termed the prize of "Honourable Mention;" whilst those who combine practical demonstration with valuable suggestion engage in important labour, from which the commonwealth cannot fail to receive much benefit; and the fact must never be allowed to be lost sight of that to demonstrate the practicability of a new invention necessitates the application of time, talent, and money to that object; and this is worthy of its own special reward according to all our notions of equity (outside of Chancery law fancifully termed equity by our lawyers)—notions that are, if not innate yet have the sanction of men of all times and many countries, and are moreover recognised and confirmed by teachings of the highest of authorities, which bids us take note that no man "goeth a warfare at any time of his own cost," or "planteth a vineyard and eateth not of the fruit thereof." But therein the practical fallacy of proposing to remunerate the inventor by any system of Government awards must be repudiated, for such a system is shewn by experience to be impractical and illusory, only to be resorted to in some very special cases where no other course appears to be open to us.

Moreover, the absolute similarity of the author's copyright, which few call in question, and the inventor's patentright, must be stoutly maintained, for they are, in truth, "as like as two peas,"—for the author puts his (more or less) original thoughts into words and makes a book (and a book, when written or printed, is literally an article of *manufacture*)—the inventor embodies the results of his thoughts and labour in a new machine or process, which the law terms a manufacture; and the patenting of an invention no more hinders the production of a better invention for the same subject, than the copyright of a book hinders the production of a better book on a similar subject.

But it must not be forgotten that if the inventor's right to a patent or special property in an invention is sound on principles of justice, it is equally sound as a matter of public policy; for who will think of relying on labour which promises no one any special benefit? For, independently of its being true that "reward sweetens labour," it is also true that most men who labour have to subsist by that labour; hence not only the spur of cupidity, but the goad of necessity is involved in the matter—two powerful instruments, whose action may be implicitly relied on when public spirit, philanthropy, and many other grand attributes of humanity are flagging or inactive. And it must be remembered that many members of the working classes are inventors, and that to them the question of obtaining their daily bread by any occupation they undertake is a paramount one. As to the particular form which any reform in the Patent Law ought to take, we feel it unnecessary to do more than remind our readers that a very good plan of reform is sketched out in the Invention-right Bill drafted by the Inventors' Institute, and already published in the columns of the Scientific Review.

But whether that plan or some modification of it be adopted, yet these primary points must be adopted - Cheap Patents (and especially cheap Provisional protection, or an equivalent for it), effective non-litigious Patents, and Patents of sufficiently long duration to guarantee remuneration to the inventor.

Reviews.

Steam in the Engine: Its Heat and its Work. By P. Kauffer, Managing Engineer, Leeds. London: Blackie and Son, Paternoster Buildings, E.C.; Glasgow and Edinburgh. 1873.

[Second Notice.]

Last month we briefly noticed the publication of this treatise, and commended it to the favourable attention of our readers. On a more careful consideration of its contents we have to remark that it is a book worthy of the attention of all engineers; indeed, of all interested in the use of steam, who have (as they should) scientific interest in the theory of its operation in the engine.

The work, which is one of only sixty-four pages, is profusely illustrated by diagrams and tables of practical results. When a subject is so fully, yet concisely, treated as in the present work, it is difficult to quote from it anything which stands out beyond other parts as particularly worthy of attention. As it would be manifestly unfair to present our readers with its whole contents, though we are quite sure *they* would profit by our doing so; we are content to afford them the following sample :—

The question (says Mr. Käuffer) whether an economy in fuel can be obtained by the use of a steam-jacket round the cylinder, is not yet decided.

It is to be remembered that free heat has to be rendered latent in every case where steam expands under performing work; and if the steam-jacket were essential for an engine, if it were of any good to the steam inside the cylinder, its duty would be to assist the steam in its own transformation. Mr. Rankine, after he was astonished that more work is shown by the diagram than the steam lost in total heat, said that this plus was the result of transformation of latent heat into mechanical work, which, he added, cannot be estimated theoretically. To give a proof to this assertion, he says that in a non-jacketed cylinder the steam, when expanding, takes the form of a mist and spray, because, as some latent heat went through the piston as work, the steam condenses partly. To my regret, I cannot accept this statement, because, as I proved by calculation at the end of articles V. and VIII., the contrary must take place, that is to say, instead of latent heat being set free during the expansion, it must be that free heat becomes latent again, because the steam takes a greater volume. Latent heat is wanted to increase the volume of the water, and if a part of this heat disappears in the steam, will the consequence not be a reduction in volume? and how is it possible to reconcile a reduction in volume with an expansion, with an increase in volume? The volume must increase, or the piston will not advance in the cylinder.

The more volume 1 lb. of steam occupies the greater must be its latent heat. One lb. steam of × 32° Fahr. wants as latent heat 1092 units, where 1 lb. steam of 8 atm. total pressure, or 339·53° Fahr., wants only 875·16 units of heat to keep it in equilibrium with the weight it has to support. The molecules are nearer to each other, and want to vibrate in a smaller circle.

Another question to be considered here is the time during which the expanding steam is in contact with the inside wall of the jacket. When using, expansively, steam of 6 atm. total pressure in the engine, the total heat wanted, per 1 lb. of steam used, is 1266 units, of which not more than about 300 units are obtained as work in the engine. Thus, we see that ¼th of the total heating-surface in the boiler was wanted to transmit the heat equivalent to the performed work from the hot flame into the *water*. Knowing the enormous difference in conductive-power between steam and water, we can easily see how much more surface would be wanted in the boiler if there were steam instead of water; and if we give on the other side of the heated plates, instead of the hot gases, only steam of not much higher temperature than the steam has inside, then we see to how great an extent we would have to enlarge the heating-surface in order to exchange the same work. Reducing now this surface to the extent of the inner wall of the jacketed cylinder, the conclusion becomes evident that in the short time of contact, say one second, the heat transmitted through the cylinder-wall must be trifling. The case of the steam-jacket is that of a superheater, with very little surface compared to the quantity of steam (especially in large cylinders), and with a very small difference in temperature between the two mediums which shall interchange their temperature.

Other arguments against the steam-jacket are, firstly, that the same amount of heat given through the wall to the expanding steam will be given to that same steam during the exhaust-stroke, and, secondly, that by the steam-jacket the cooling-surface exposed to the external air is enlarged, and that this cooling is rendered more effective.

Many hundreds of steam-jackets have been applied in practice, and no maker and no user can state their value. I know of only a few experiments made with jacketed engines, and they are not conclusive enough to show any effect of the jacket produced inside the cylinder.

The opinion of some engineers that the steam should have still a few pounds pressure above that into which it exhausts, in order to leave the cylinder easier, is certainly erroneous. As soon as the exhaust valve opens, the steam takes immediately the volume corresponding to the pressure into which it has to flow, whether it were or not still compressed at the end of stroke. Were it compressed, it will be warmer than it should be at the corresponding pressure, and this raises the back-pressure, especially at a high speed.

That the steam-pipes and steam-ports for admission, as well as for exhaust, must be made as large in area and as short as possible, is a fact sufficiently known. The diagrams taken from working steam-engines show, often clearly, that the steam, which was at its maximum of saturation when leaving the boiler (it is well understood that I do not allude to any priming), had been superheated by keeping its original temperature, although the pressure is lowered when being forced through narrow passages into the cylinder. Consequently, without having steam warmer than before, this originally saturated steam is now to be called superheated steam, and has, as such, less energy than when at its maximum of saturation, compared by volume and pressure.

A certain increase of the expansion curve is in every engine caused by the clearance, which, being a volume not shown on the diagram drawn, but which was filled with full-pressure steam, causes the curve to be one corresponding to a longer introduction than the diagram shows, longer by the volume of the total clearance expressed in parts of the stroke. This correction must be made in every diagram before examining the law followed by the steam.

Speaking of correcting diagrams, Mr. Kauffer says, I must add a few remarks on a correction which is generally, even in scientific treatises, entirely neglected. This correction is not wanted for measuring the work performed by the engine but it is certainly worth remembering in many cases in practice,—that is, the relative position of the back-pressure curve to the curve of the effective working-pressure. A diagram drawn from the front-end of the cylinder does not show the work performed during the front-stroke, because the diagram is composed of the steam-curve during the front-stroke, and of the back-pressure curve of the bottom-stroke; and if the real indicated work of the front-stroke alone is to be considered, we have to take the back-pressure curve of the bottom-stroke, and to place it instead of the back-pressure curve shown on the diagram. In cases of an unequal back-pressure this correction changes the diagram entirely with regard to uniformity of work.

Celestial Objects for Common Telescopes. By the Rev. T. W. Webb, M.A., F.R.A.S., Vicar of Hardwick, Herefordshire. Third Edition, Revised and Enlarged. London: Longmans, Green, and Co. 1873.

The present edition of this now well-known and highly appreciated treatise is a decided improvement upon the two which have preceded it, the additions being such as render the work more accordant with the present state of science. Mr. Birks, and others, have, it appears, assisted the author in enriching the lunar map attached to the treatise. From the sidereal part some few objects of inferior interest have been omitted, but in their place nearly seventy fresh ones have been introduced. In the Appendix many useful things are introduced, such as Declinations in the Right Ascension Index, and recent information as to the planet Venus.

As this work is one that was originally introduced to public notice not a few years ago—and has been allowed, for various reasons, to remain out of print for some length of time, probably it may be wholly new to many of our readers; hence a sample of its style will be acceptable, as it will be seen it is of a readily readable kind rarely to be met with in books which contain such a full quantum of the technicalities appertaining to a science as Mr. Webb's book does.

Comets.—On this ever-interesting subject Mr Webb remarks that when Kepler stated his belief not merely that comets inhabited the æther as fishes the ocean, but that the ocean was not fuller of fishes than the æther of comets, his contemporaries probably amused themselves with his luxuriant fancy, but that modern discoveries have proved that a vast number of these bodies exist. Many of them are so faint, and so much alike, as to afford little interest to the generality of observers. In fact, as Mr. Webb states, the light of most comets is too faint for high powers, and demands a contrast with the dark sky which small fields do not admit to get the whole extent of head or tail the lowest power should be chosen, and for the tail the naked eye will be more effective than any glass, except the appropriate instrument called a comet-finder. High powers may be used for the details of the nucleus, but the contraction of the field and the want of contrast must always be allowed for. Small comets are frequently nothing but luminous mists without trains, sometimes without central condensation,—as we ascend in the scale, nuclei, trains, envelopes, and various anomalous appearances succeed, depending no doubt upon diversities in the materials of the comets themselves, as well as on their degree of approach to the sun. Even Venus was thought to have influenced the aspect of the "Donati" as it passed near her. In common language, a comet consists of *head* and *tail*, but we have to make a telescopic analysis, and shall begin with

1. The Nucleus: the most luminous part, occupying in a general sense the centre of the head. It is sometimes absent in telescopic comets, which are mere fogs, permitting the minutest stars, even such as would be effaced by the slightest terrestrial mist, to be seen through the very centre;—thus, Herschel II. saw a group of 16 and 17 mag. stars through the heart of the comet of Biela in 1832: from this diffused state they present every stage of condensation, including sometimes a sparkling or granulated appearance, up to the aspect of a star, which has occasionally, as in 1744, equalled

Venus in brightness, and been visible to the naked eye in broad noonday, or, as in 1843, blazed out yet more splendidly like a bright white cloud, close to the glowing meridian sun. [Other comets visible by day (omitting some questionable ones):—A.C. 43, the star of "the mightiest Julius," which appeared during the games held soon after his assassination, and gave rise to the star on the forehead in his coins and statues;—1106, 1402, 1577 (Tycho's great comet), 1618. That of Feb. 1847 was seen by Hind, and that of Aug. 1853, by Hartnup and Schmidt very near the sun; but in each case with the telescope, in which they shewed planetary discs. Donati's comet was not visible, except with very powerful instruments, by day.] High powers usually dissolve any apparent solidity, and different instruments may give very different sizes to what looks like a planetary disc, throwing much doubt upon its reality sometimes a very minute point (as Herschel I. found in 1807 and 1811) holds out against any magnifying, and this—like broader nuclei—is not always central in the head. In some comets (1618, 1652, 1661, 1707, Winnecke's 1869) the nucleus seems to have been composed of separate masses,—a marvellous structure; would that we could study it with modern advantages! Had "the Donati's" nucleus passed about 20' further N., it would have gone right over Arcturus—and we should have obtained some negative information at any rate as to its composition. Miss Mitchell alone seems to have witnessed the central transit of a comet (1847) over a 5 mag. star, which shone through it unchanged; some minor examples are less conclusive. Were a defined phasis to show itself, a certain amount of density might be inferred; but if we except "the Donati" as seen by Dawes in daylight, Oct. 8, this has never been satisfactorily the case, as the retroverted form often assumed by luminous sectors throws a doubt upon the observations. The darkness close behind the nucleus in 1858, if not real shadow, seemed at least to prove that the nucleus was not permeable to the solar energy, in whatever way exerted, and that it had no rotation upon an axis. The arrival of the next great comet will be a season of absorbing interest. The spectrum-analysis, first of Donati, subsequently of Huggins and Secchi, has shown not only the native light of 7 small comets, but, what had been little anticipated, their gaseous character, the comets of Winnecke II., 1868, I., 1871, and of Encke giving a spectrum corresponding with that of the *vapour of carbon*;—a discovery so much the more unexpected, as this element is peculiarly unsusceptible of such a modification. There can now be little doubt that such is the constitution of larger specimens also, but probably with much variety in composition, as the acknowledged difference in colour makes sufficiently evident.

2. The Coma is the sphere of mist around the nucleus, forming, in popular language, the *head*; this is sometimes of considerable extent—2° 40', or 5 times the moon's diameter, in 1770, when the nearest recorded approach of a nucleus to the earth took place, of 1¼ millions of miles. The coma fades away into the surrounding sky, with an outline, including that of the commencing tail, usually considered parabolic; Bond, however, found in 1858 that its section approached much more nearly to a catenary curve. Its denser part, if distinguishable by any set-off or outline, is called

3. The Envelope. This is an interior and brighter layer of mist, suspended as an atmosphere around the nucleus, at least where exposed to the sun. In Donati's comet some observers (amongst them myself) carried it a good way round the back of the nucleus; but usually it turns straight off on each side to form the commencement of the tail: within it is sometimes a darker narrow band, separating it from another interior and brighter envelope. [As to this, Huggins has made the important remark that these non-luminous spaces may correspond to a condition of the vapour too cool to emit light, and yet not condensed so as to reflect it.] In 1858 no fewer than four such dark spaces at once were sometimes shown by the great achromatic at Cambridge, U.S., indicating the consecutive rising of five shining waves, which had spread themselves in succession outwards from the nucleus, the latter seeming to diminish in size and brightness after each of these emissions of luminosity. Madler, at Dorpat, noticed an actual increase of one of these envelopes from 18" to 27" in 2h. In 1811 the whole coma and envelope were raised in one parabolic mass from the nucleus, which was surrounded by clear dark sky on every side: when the extreme diameter of the luminous cloud amounted, according to Schroter, to 947,000 miles, considerably exceeding the bulk of the sun, and almost doubling the moon's orbit. As this comet receded, the dark space became indistinct, and the envelope sank finally down upon the nucleus. Envelopes sometimes contain dark spots and streaks (1858), and more frequently brushes or fans of light, where the shining matter seems to stream out from circumscribed portions of the nucleus; these are rapidly variable, and in Halley's comet, at its return in 1835, showed such a vibration from side to side, traceable from hour to hour, that Bessel inferred some powerful polar force unconnected with gravity. Such a swinging was less distinctly recognised in 1858. In Comet II., 1862, in which these aigrettes were very striking, Secchi and Chacornac found no motion of this kind, but that the jets proceeded alternately from different parts of the nucleus. The envelope and coma together form the origin of

4. The Tail. This, when not greatly foreshortened, appears as a long cylinder, or more usually cone, widening in general as it advances, and showing a hollow structure by an interior darkness. There seems, however, a doubt of the adequateness of the explanation, since the perspective of 1858 required a very different proportion either of the *breadth* or the *intensity* of the dark space: some other cause may possibly be combined with vacancy to produce the effect. This interval in the Donati was very dark close behind the nucleus. Schwabe found it darker than the twilight sky, and Dawes and Hartnup considered it *real shadow*. In 1811, however, such a vacancy surrounded the nucleus on every side. The division into two streams effected by it was seen with the naked eye in the great comet of 1577, which astonished Tycho at his fish-pond before sunset, and it has been frequently noticed since the discovery of the telescope; in 1843 it was absent; and a brighter ray filled the middle when Halley's comet, in 1835, was withdrawing from the sun. The preceding stream, according to the comet's motion, is usually brighter and sharper defined, as well as curved backwards. Kepler noticed this in 1618, and compared it in his own graphic way to the appearance of a heap of corn swept over by the wind in the threshing-floor: and no one will forget it who saw the form of the Donati. It has been usually referred to motion through a resisting medium, but Pape, from an elaborate investigation, finds that the curvature may be explained by the combination of the comet's motion with a repellent power in the sun. The axis of the tail was calculated by him to differ 6 deg. 18' from exact opposition to the sun, being left a little behind;—a deviation of which there have been previous examples. The length of the tail is sometimes enormous. According to Boguslawski, that of the wonderful comet which in 1843 nearly grazed the surface of the sun, and, as Secchi expresses it, issued from it like a dart of light, was cast away to the almost incredible extent of 581 millions of miles—more than 6 times the distance of the earth from the sun, and crossing the orbit of Jupiter: and this astounding stream, the longest object, as far as our senses can reach, in all space, must have been shot out with an equally inconceivable velocity after passing the perihelion; for, but a short time before, the head was on the other side of the sun, half round which it had been whirled in 1½h. or 2h., and under such circumstances the whole direction of the same tail could not be supposed to have been reversed. Even should the length be considered to be overstated, we certainly have before us here one of the greatest marvels in the universe. Minor trains are occasionally seen; in some cases (1769, 1811) the prolongations of an outer envelope; in others apparently separate branches (1806, 1843); according to Cheseaux, six of them, each hollow, formed a glorious fan in 1744. A straight, long, narrow, and very faint ray of this kind, directly opposite to the sun, was seen by several observers steadily preceding the great curved tail in 1858. The grand visitor of 1861 had a straight and a curved tail, the latter of which probably swept over our globe, or, according to Liais, buried it to a depth of 110,000 leagues. From certain periodical returns of lateral streams, Dunlop, in 1825, inferred a rotation of the tail in 20½h., and similar appearances were noticed in 1769 and 1811, but the explanation is, perhaps, precarious, from the immense velocity required. An additional stream has sometimes, though rarely, been directed *towards* the sun; this extraordinary phenomenon, called an *anomalous tail*, was noticed in 1824, when it was longer and brighter, though narrower and more tapering, than the usual one; subsequently it was found recorded that the grand comet of 1680—Newton's comet—had left a similar glowing wake upon the æther; and it has since been noticed in 1845, 1848 (Encke's,—perhaps again in 1871), 1850, and 1851. The principal tail in 1858 was seen by the Americans crossed obliquely by a number of brighter bands like auroral streamers, diverging from a point between the nucleus and the sun.

A few other details should be noticed. Coruscations, or flashings, have been often remarked in the tail: that of 1556 was said to waver like the flame of a torch in the wind; and numerous other instances might be given, before and since the use of telescopes. The accurate Hook took many precautions before he satisfied himself of their reality in 1680 and 1682, and Schroter stoutly maintained their existence in 1807, referring them to electricity or some analogous cause; others negative them as too rapid for the progressive motion of the light by which we should see them,—an objection, however, applying only to foreshortened tails, and treat them as illusions depending on our own atmosphere, or the uncertainty of weary sight. Polarization experiments concur with spectrum-analysis in discrediting their reality, by showing that the tails, as well as comæ, shine by reflected light, owing probably, as Huggins *suggests*, to the cooling of the incandescent material of the nucleus. These researches have of late made a rapid stride. But many points are still very incomprehensible. "Omnia incerta ratione, et in naturæ majestate abdita."

The *colours of comets differ*; a wide margin must be left for the *superstition of the ancients, who dreaded the herald of disaster*, "*terris mutantem regna cometen*," and held it as a *malignant genius* that

—From his horrid hair
Shakes pestilence and war.

Those who noticed the fiery hue of the sabre-like comet that passed to the E. at the commencement of the Crimean war will understand with what feelings our fathers would

have gazed upon it, like the astonished spectators of the comet of the Northern Conquest, represented in the Bayeux tapestry with the inscription "isti mirantur stellam:" nor will the exaggeration of those beautiful lines seem unnatural,

> ——liquida si quando nocte cometæ
> Sanguinei lugubre rubent.

It is, however, certain, both from the Chinese and modern observations, that there is much general difference in respect to colour. Herschel I. even found the nucleus of the same comet (1811) pale ruddy, the envelope greenish or bluish green; and a similar contrast was noted by Struve I. in Halley's comet in 1835, and by Winnecke in 1862. That the sun induces in them a polar force superior to that of gravitation—the hypothesis, in the main, of Olbers—is most probable from the form of the envelope and tail, as if repelled alike from the nucleus and sun; and that a certain portion of the rarer material is dissipated during the perihelion passage is evident from the very aspect of a tail such as that of 1858, whose restoration to the rapidly advancing nucleus is, to our apprehension, an impossibility. And in this, and in the destructive resistance which one comet (that of Encke) is known, and all may be presumed, to suffer, from the denser æther around the sun, we find a striking indication that our system was not made to be eternal. The perfect balance of its construction might at first lead to another impression, and seem to countenance the old objection, that "all things continue as they were from the beginning of the creation." But here is evidence to the contrary—a slight but decisive symptom that—"they all shall wax old as doth a garment"—that "they shall be changed." A similar cause has probably been acting upon the comet of Biela; whose separation into two parts is one of the marvels of modern astronomy. Single in all previous observed returns (those of 1772, 1805, 1826, 1832), in 1846 it became elongated, and then threw off a portion which increased till it rivalled, and even for a short time surpassed its parent, each having at one period a starry nucleus and short tail, while they were connected by faint streams of light and thus they continued in sight for more than three months, keeping a distance of something more than 150,000 miles, the companion being the first to vanish. When next seen by Secchi, in 1852, the distance was more than eight times greater, being 2m in RA, and 30' in Declination, as though they were becoming independent bodies: their next favourable return (1866) was looked for with no common interest; but they were not seen, and probably will never again be seen by mortal eye. Nor has the larger comet of De-Vico, discovered by him in 1844, with an apparent period of 5½ years, ever shown itself again. It has—

> —wandered away alone
> No man knows whither.

The identity of the orbits of two comets (II, 1862; and I, 1866, believed to be the same as that of 1366) with the paths of the meteor-showers in August and November is one of the most remarkable of modern discoveries, for which Schiaparelli has recently received the Gold Medal of the Royal Astronomical Society. It is, however, needless, in a treatise like the present, to make more than a passing allusion to a subject of this nature.

General Literature.

Lord Harrie and Leila: a Romance of the Isle of Wight, and other Poems. By Henry George Hellon. London: Provest and Co., 36, Henrietta-street, Covent-garden, W.C. Fcap. 8vo., 200 pp.

Dr. Johnson's Prince, in "Rasselas," soon found that he could not be a poet by imitation, and that he must seek the scenes of nature as a field for his imagination and fancy. Pope's prolific genius first exhibited itself in pastoral poetry. Mr. Swinburne is, perhaps, the most original poet of the day; Mr. Morris—whose songs and legends in imitation of Chaucer have met with the applause they justly merit from the readers of poetry—may fail to find a hearing in the future. The world is moving in another vein; originality alone will live, but the laws of poetry will ever remain the same. Nevertheless, at the present time the majority of poets are imitators, imitation, if not too close, being by some considered a safe path as following the style of a great and successful poet. Moreover, imitation is easy to men of ordinary ability.

Now that poetry is taking a high place in literature, and rising from the grave to which it has been doomed for the last fifty years; it is a pleasure to meet with a new singer at the shrine. The poems in the volume before us possess a refreshing originality. Mr. Hellon's genius is varied and healthy, he grasps nature in various forms. This is, undoubtedly, the finest form of poetry, it was from Nature that Byron, Shelley, and Keats drew their inspiration.

The romance, which occupies the greater part of the volume, is full of descriptive scenes, interspersed with songs both grave and gay, founded on the history of the island. The romance is written in nine cantos, two of which are written in the Spenserian or ottavarima stanza, and the remainder chiefly in octosyllabic. The following is worth quoting, as descriptive of a trait in the character of Lord Harrie in boyhood:—

> He loved the ocean—it was his delight
> To watch the glory of its rolling wave,
> Climb the rude rocks where only eagles light,
> Or muse in some secreted, sea-bound cave,
> Where the tossed billows, wildly foaming, lave,
> And listen to the music of the spray
> As it returned, as glorying to brave
> Another Creature, or in surges play
> Till drawn again, and lost in many shades away.

Our columns do not allow space for satisfactory quotations, or we might quote many verses that would give pleasure to the lover of poetry.

There are many ballads of graphic character, we note two in particular, "Chale Bay" (called in the Doomsday Book "Cela"), and the legend of "St. Boniface and Fair Annie." Mr. Hellon occasionally indulges in a poetical licence in rhyme to preserve the rhythm, but this is no serious blemish when compared with some poetry of the present day. We, however, advise Mr. Hellon to steer clear of such licence in future.

Perhaps the most complete of the miscellaneous poems is that in memory of the Prince Consort, which is elegant in language and full of pathos. It is this which has attracted the notice of her Majesty the Queen, who has very graciously accepted a copy of his works from the author.

We note that Mr. Hellon appears fully to understand the composition of heroic or blank verse, and the proper use of the true iambic and spondee. Of all verse this is the most tortured, and a stumbling-block with many. It sometimes falls to us to review verse of eleven, twelve, and even thirteen lines written for blank verse, instead of the true heroic or ten syllable line. We might point to some very popular poetry of the day, now largely read, where this verse is sadly abused—where lines of all character are jumbled into a huge mass of words. Of all poetry extant in this verse, "The Dream," by Byron, is the most perfect.

The sonnets are very elegant, and give great promise. The majority are after the Italian model, with not a few thoughts and fancies. They remind us strongly of Keats, who, no doubt, has an admirer in Mr. Hellon.

Jest and Earnest. A Collection of Essays and Reviews. By George Webbe Dasent, D.C.L. 2 vols. Chapman and Hall.

There is a good deal of very pleasant reading in these volumes, and though their contents appeared in some one or other of our periodicals, including the *Times*, they are not the less pleasant on that account in their present form. Many people object to these reproductions, and occasionally, it may be admitted, they come to us when we had rather they had remained where they originally appeared. In this matter, however, they labour under no disadvantage, not belonging to literary efforts which never saw the light, until they came before the world in such colour and form as the taste of the publisher dictated.

We grumble, however, with Mr. Dasent, because he has, to some extent, overdone his work. Most of the essays and reviews now put forth in these volumes are good and pleasant reading, and must have been pronounced so when they first appeared. But there is one called the "Story of Free Trade," after the manner of Herodotus, which is extremely offensive, not only in consequence of the manner in which it deals with the names of some of our most esteemed and honoured statesmen, now no more; but for the objectionable tone of thought by which it is characterized from beginning to end.

Turning from this to what is pleasanter, we enjoy thoroughly Mr. Dasent's excursion to Faroe, and the strange, because unusual, description he gives of streets, quays, outlying landscapes, and other features, by the people who go about doing their business, taking their pleasure, and filling up the sum of their lives without knowing or caring much about the great outside far-away world, or the lofty ambitions and great affairs by which it is agitated and tormented. We cannot imagine Thorshaven to be a pleasant town to visit in, or to make love in, to be born in, or to die in; and yet, no doubt, the ladies manage to get together, and talk scandal, and speculate on the prospects of the whale fishery, and munch dry fish, whilst the young steal in the evening, through the odour of ancient sea produce, to meet each other with bright eyes and throbbing hearts. If every town cannot be as handsome outwardly as some of the proudest are, the inner life differs far less, and up amongst the whales in Faroe they manage somehow to get on. "The town," says Mr. Dasent, "is built round the rocks which gird the haven, in the hollows eaten by the waves into the trap formation, and not only round, but up and down, in a strange fashion, the streets are narrow, and the houses mostly of wood; all about the place are joints of whale hung up to dry; for that mammal's flesh ekes out many a meal in Faroe—fish, and whale, and mutton,—mutton, whale, and fish,—scale and skin, and skin and scale; so runs the round of life from hour to hour in Faroe." Primitive enough this, and homely to the last degree of homeliness, and the people harmonise in their personal appearance with their surroundings. Mr. Dasent takes leave of one of his distinguished entertainers thus:—"Worthy Sysselmand, how shall we ever repay thee for thy kindness to us? Even now we see thee before us, in thy photograph taken in thy dark velvet jacket with silver buttons, thy tight-fitting hose, and shoe-strings crossed high over the ancle. Member of the Danish Rigsdag, the king's sheriff in Faroe; a man of the simplest manners and most varied knowledge and intelligence; great in whale lore and fowl lore; strong in deep-sea fishing; a great gatherer of strange over-sea waifs; a man who, if he had a chance, would catch the great Auk himself and bring him home alive; who knows all the gulls and their eggs, and has often been over the cliff on the 'rope' to take them."

There is much more in this essay well worth reading, and we could give our readers many an exciting and pleasant passage, but we leave them to search the volumes for themselves, where they will find much concerning Northern lore, as well as Northern life, pleasant and even profitable to be acquainted with. Going from the first essay in the volume to the last, which is entitled "Pickings from Poggio," from which we meant to cull a good story or two, but on looking over them a second time we found that they had all, in some form of disguise, already been made known to the public, and so we leave them untouched for the delectation of the curious reader, who may decide to go to Mr. Dasent's volumes.

STEAM LOCOMOTION ON COMMON ROADS.

By John Head, Assoc. Inst. C.E.

The following is the substance of the paper which was read at the Institution of Civil Engineers, on the 8th of April, 1873:—

The author commenced by reviewing the history of the road locomotive from the time of its introduction, about the year 1827, up to the present time, showing the energy and talent which had been displayed by Gurney, Hancock, Scott Russell, and other of the early inventors between the years 1825 and 1834, and the great difficulties which appeared to beset them in their endeavours to introduce steam on common roads.

It was also shown that a great demand existed for more rapid communication, on account of the increasing traffic which began to be developed about this time in England, and although a great many persons were in favour of improving the traffic on common roads by the use of steam power, it was soon found that although the first outlay for a railway between two towns was much greater than for a service of steam coaches on existing roads, on a scale commensurate with the requirements of the time, yet the iron road laid on a level must in the end prove successful, on account of the difficulties in the latter system of dealing with the increased traffic, the impossibility of manœuvring two carriages, or even one, on a narrow or badly metalled road, and lastly, the common right which every inhabitant of the country had to the turnpike road, in addition to the power possessed by trustees, of fresh metalling the roads and imposing tolls, which were often more per diem than the total cost of running the engine.

These insuperable difficulties had caused the abandonment of steam locomotion on common roads until about the year 1856, when the subject was again revived, with a view to the adaptation of these engines for agricultural purposes, and up to the present time the attention of engineers interested in the subject had been diverted almost entirely from the question of passenger traffic—and to a great extent also from the conveyance of goods—and devoted to the study of agricultural requirements, although during the past two or three years a good deal of attention had been turned to reviving the subject of passenger traffic, not only on common roads, but also for tramways. The use of these engines for military purposes had also claimed serious consideration.

Before commencing a description of the various locomotives, the author took up the consideration of the various driving wheels which have been designed, as they performed the most important functions in the component parts of a traction engine. They might be classed under the heads of elastic, flexible, and rigid.

An "elastic" wheel was understood to be one whose structure was sufficiently resilient to answer the purpose of bearing springs, but the circumference of which did not necessarily deviate from the circular form by the pressure of the tread. A "flexible" wheel was one whose treading face suffered a material change of form as it rolled along, so as to have a large portion of its periphery continually in contact with the ground.

The following table, compiled partly by Lieut. Crompton, and partly from other sources, showed the resistance of smooth rigid wheels, in lbs. per ton, on different surfaces, although in some cases, they appeared rather high :—

On very good pavement .	=	35
,, good macadam	=	60
,, ordinary macadam ..	=	90
,, newly laid gravel	=	200
,, soft grass land	=	300
,, newly laid metal...	=	410

Descriptions were given of several wheels designed by different makers.

The India-rubber wheel of the late Mr. R. W. Thomson was designed to act as a spring, and also to increase the adhesion through the flattening action of the India-rubber at the tread of the wheel. Mr. Thomson stretched a ring of India-rubber about 5 inches thick round a wheel formed like a drum, allowing the India-rubber to rotate if necessary. In the early experiments it was found that the India-rubber slipped on damp roads and greasy mud, and was also very liable to be damaged by various substances found on the roads. Mr. Thomson, therefore, designed a sort of armour, consisting of flat plates turned over at the edge and joined together by links. This species of armour gave much trouble, owing to the continued breakage of the link pins and the difficulty of keeping the tire in its place, unless the shoes were very tight. Messrs. Aveling and Greig, also Mr. Thomson and Mr. Burrell have much improved these shoes; in the former case this is accomplished by discarding the links and substituting an attachment of the shoes to the rim of the wheel, and in the latter case by allowing the steel plates to touch each other and lap over and clip the angle iron rim of the wheels on both sides. These latter shoes had been found to answer in practice better than the former ones, but up to the present time the experiments had not been of sufficient duration to form any trustworthy data of their permanent success.

The India-rubber tire had the great advantage of being a perfect spring to the engine, and formed a safe and sure break. Its resistance on good macadam was more than a rigid wheel, although on a rough and newly metalled road the flexible wheel had a great advantage, owing to the great surface of its tread. Over paved roads the rubber or any other flexible wheel, was decidedly superior to the rigid driver, owing to the increased amount of surface of adhesion in the former.

One of the principal drawbacks to the use of India-rubber tires was their great prime cost. The cost of the tires for the "Ravee," built at Ipswich for the Indian Government amounted to £211; and of the "Sutherland," which was smaller in diameter but of great width, £234.

It was difficult to form any correct formula for the depreciation of these tires, owing to the paucity of the experiments hitherto conducted, and the short time which engines on this patent have been at work. The Duke of Sutherland stated that after running 1,000 miles during 90 days, the India-rubber tires weighing when new 1,337 lbs., were reduced to 1,202 lbs. or about 10 per cent. Mr. C. F. White, of Aberdeen, ran 4,400 miles with his tires in 300 days, and the weight was diminished in this time from 1,267 to 1,133 lbs. or about 10 per cent. The tires have been relined with thin India-rubber and are now working satisfactorily. Lieutenant Crompton wrote from India—"The tires of the driving wheels wear well and are not affected by the heat," and he hoped to run 8,000 miles with a set.

Adam's wheel. This wheel was purely elastic and only acted as a spring to the engine. It consisted of an ordinary centre and arms, having a heavy T iron rim, between which and the outer tire were inserted treading blocks of rubber about two inches thick. These blocks are kept in position by means of two angle irons, rivetted to the outer rim. A drag link connected the outside tire with a T iron ring.

In Bremme's flexible steel tire wheels the flexible tire was formed of one or more rings, and each of these rings was constructed of one or more bands of steel or other similar materials; to the tire were attached an adequate number of arms or links, which made the connection between the tire and central part of the wheel, so that the arms or links projecting a given distance beyond the periphery of the central part were able to support the lateral thrust or pressure which the wheel might be exposed to, and were free to adjust themselves vertically to any curve the elastic tire might assume under a dead load at the axle moving towards the centre.

In the experiments conducted by the Royal Agricultural Society in Wolverhampton in 1871, by Messrs. Bramwell and Easton, with an engine fitted with Thomson's patent India-rubber and smooth cast-iron wheels, of the same width and diameter, and another 10 h.p. road locomotive, with iron driving wheels, with cross bars cast on the rim, it was found that the co-efficient of adhesion of the India-rubber was ·45, that of the large cross-bar wheel of the 10 h.p. engine ·35, and the plain cast-iron wheel ·214, and that the India rubber tire would take a gross load of five times the insistent weight upon the drivers up an incline of 1 in 18: the cast-iron tires with cross bars 3·75 times the weight on the drivers up the same incline, and the cast iron solid smooth wheels not more than three times the weight.

With respect to passenger engines, it was stated that Gurney, of London, was the first person who perfected a passenger locomotive which was able to run for hire against a stage coach. The external appearance was like a large mail coach, the cylinders were horizontal, and coupled direct to a pair of 5 feet drivers. The boiler consisted of a net-work of 1¼ inch tubes, within which was a fire, the necessary draught being caused by a fan blowing into a close ash-pan. The great defect in this engine was the cranked axle, which continually broke. The boiler tubes also gave much trouble from leakage.

Hancock, of Stratford, was by far the most successful of the numerous steam-coach builders who flourished between the years 1827 and 1831. His engines were self-contained omnibuses, running on four wheels, the cylinders were inverted and geared to the main axle by chains, with a ratio of 2 to 1, the boiler was about 2 feet square and 3 feet high, and filled with flat chambers, connected together, the outer pressure being taken by two strong wrought-iron plates, firmly secured by cross bolts and girders; the draught was kept up by a fan, driven from the crank shaft, discharging into a close ash-pan. This engine ran for some time regularly between the City and Paddington, and three of them were worked for five months on the Paddington Road, running 4,200 miles and carrying 13,000 passengers. The average speed, when out of towns, was about ten miles an hour; but they, at times, attained a speed of twenty miles per hour.

The passenger road engine, designed by Scott Russell, was similar in appearance to a large family coach. The engine had two vertical cylinders, geared 2 to 1 to the driving wheels. The boiler was rectangular, with internal furnaces and return tubes on the same level, like a miniature marine boiler. Behind the engine a sort of two-wheeled cart carried the fuel and water, and formed extra passenger seats. Six of these engines ran between Glasgow and Paisley,

in 1834, and carried a large number of passengers at a good speed.

After the year 1838 little or nothing was done with passenger engines until 1871, when Mr. Nairn, of Leith, started a steam omnibus called the "Pioneer," between Edinburgh and Portobello, and several engines had been constructed with Thomson's patent wheels for passenger traffic, the chief of which had been for foreign use. The largest of these were four engines, constructed for the Indian Government, by Messrs. Ransomes, Sims, and Head on the above patent. The cylinders were vertical and placed behind the boiler, which was on the "Field" system, with a very large amount of heating surface. The steersman and stoker were in front of the engine, all the handles for working the engine being alongside the steering wheel.

One of these engines, the "Raven," made a double journey between Ipswich and Edinburgh in October, 1871, a total distance of 860 miles, which was the most remarkable run ever made by any road locomotive. The average speed was about 6·9 miles per hour for the time actually running, but on several occasions a speed of 15 and even 20 miles an hour was maintained for short distances.

STREET TRAMWAY LOCOMOTIVES FOR PASSENGER TRAFFIC.

Many means had been proposed for propelling street cars, and several of these, such as compressed air, ammonia, and carbonic acid had been actually tried; but although each of those or other plans had been made to perform the functions for which they were designed, and might even be useful under exceptional circumstances, it might be taken for granted that the usual means of working street tramways by mechanical power would be by ordinary steam-engines made and specially adapted to the street traffic.

It was stated that there were only two feasible ways of applying steam power to tramways, 1st, by means of a self-contained steam car, running upon four or more wheels; and 2ndly, by a detached engine drawing one or more cars.

The first of these systems had been successfully adopted on some lines in America, but it had the objection that the passengers did not like to be in such close proximity to the boiler, and if it were generally adopted the existing tramway companies must purchase entirely new rolling stock. This principle of construction had, however, the advantage in ascending heavy inclines, that the whole weight of the car, engine, and passengers could be utilised for adhesion.

The second system permitted the use of all the existing rolling stock of the present horse tramway companies with but little alteration, besides being more in accordance with the principle adopted on railways, and generally approved of by the travelling public.

It appeared to the author that one of the best street tramway locomotives yet proposed was that designed by Mr. Leonard J. Todd. It was, however, only intended for light traffic. The double cylinders, guides, crank shaft, and gearing were placed in a close box on the top of the boiler. The driving wheels were of the Mansell construction, 6 feet in diameter, and fitted with steel tires. The engine, when drawing a single forty-passenger car, was calculated to give an effective power of 12 h.p., and weighed, when loaded, about 3½ tons. A silent blowing fan of an ingenious construction driven by the exhaust steam was placed in communication with a close ash-pan. This apparatus besides being silent was also self-acting, starting, and stopping with the engine. When going up an incline the back pressure increased and the fan ran fast; when going down hill, the steam being almost shut off, the speed of the fan was very much reduced, and the blast in the fire-box diminished.

ROAD LOCOMOTIVES FOR THE CONVEYANCE OF GOODS.

Many engines had been designed for this purpose, but up to the present time few have been used solely for this purpose in England, in consequence of the present state of the Road Locomotive Act, and the difficulties which were always attendant upon the manipulation of a train of waggons on a common road, when it was necessary to uncouple them, or to shunt, or, in fact, to carry out any of the various operations which are always more or less attendant upon the management of several waggons coupled together, except they run upon an iron rail or tramway.

The cost of haulage by steam as reckoned in the the following table, may be considered as approximately correct —

	Per ton per mile.
Horses on common roads	6d. to 12d.
Steam	3d. ,, 4d.
Horses on tramway, if nearly level . . .	2½d. ,, 3d.
Steam on tramway .	1½d. ,, 2d.
Steam on railway . .	½d. ,, 1d.

Boydell's engine, manufactured by Charles Burrell, of Thetford, the "Steam Elephant," by Taylor, of Birkenhead, and some locomotives by Tennant, of Leith, were amongst the earliest goods engines used in this country; but although they possessed great tractive powers, they were all too heavy and cumbersome to be used economically, and the wear and tear was found to be very great.

Messrs. Aveling and Porter, of Rochester, designed one of the most successful goods engines, about ten years ago, and several of them were at work in this country, although a larger number had been exported to foreign countries.

In the autumn of last year a trial was made with one of Messrs. Aveling and Porter's engines in America, by Professor Thurston, who, in an interesting paper read before the Polytechnic Club of the American Institute, gave the following extract of his experiments:—"The expense account, when doing heavy work on the common road, under the described conditions, by steam power, is less than 25 per centum of the average cost of horse power, as deduced from the total expense of such power in New York State, while, if we take for comparison the lowest estimate that we can find data for in our whole country, we still find the cost of steam power to be but 29 per cent. of the expense of horses. We may state the fact in another way, a steam traction engine, capable of doing the work of 25 horses, may be purchased and worked at as little expense as a team of 6 or 8 horses."

The late Mr. R. W. Thomson, of Edinburgh, also constructed an entirely novel form of road locomotive, which he designated by the name of "Road Steamer," and he was certainly the first to reduce the weight of the traction engine, and to introduce several material improvements which, when modified by experience, would be found beneficial to the progress of steam locomotion on common roads. Mr. Thomson's engines were easy to manage, and were able to draw a large amount in proportion to their weight, owing to the introduction of India-rubber tires on the driving wheels, and, considering the speed at which these engines could run, the machinery was kept in better order through the elasticity of the India-rubber acting as a spring, than in any other system yet adopted.

Messrs. J. Fowler and Co., of Leeds, whose firm was well-known in connection with the steam plough, had also devoted much attention to locomotives for common roads, and their present engine might be considered as one of the best yet designed for the purposes of heavy traffic. Several of these engines were employed in Yorkshire and elsewhere, for transporting coals, minerals, &c., and one of them, fitted with India-rubber wheels, had been continuously at work for some time over paved roads and heavy inclines, in the neighbourhood of Bradford, at a cost of not quite 4½d. per ton per mile, or 11d. per ton the whole distance of 2½ miles, which would have cost, with horses, 2s. 6d.

STEAM ROAD ROLLERS.

These have only been brought into use in England during the last few years, although they have been employed in Paris since 1864.

The rollers hitherto made by Messrs. Aveling and Porter, and generally in use in England, were those weighing about 15 to 20 tons, with driving wheels respectively of 5 ft. and 5½ ft. in diameter.

The working expenses might be calculated at about 15s. per diem, and the number of square yards rolled for the above sum will average 2,000 per diem, but, of course, much depends upon the state of the material to be operated upon. An average of from 10 to 12 yards may be rolled and consolidated for one penny.

After several years' experience with the road rollers hitherto constructed, Mr. Aveling discovered that they were rather too heavy for making new roads, and too broad for narrow or crooked places, in addition to which they were not well adapted for haulage, which was an important feature in the economy of road construction by steam power. He therefore designed a new road roller, which somewhat resembled one of his traction engines, with the driving wheels converted into rollers, and the space between them covered by a pair of front rollers which also act as steering wheels. These front rollers were made conical or dished, in order that on the ground line they may be close together, while above their axle there is a space for a vertical shaft, which serves as a support for the front of the boiler. To the extremities of this axle a forked or saddle piece was attached, to act as a guide for the steering chains, and these chains passed rearwards to a transverse roller, which was acted upon by a worm and pinion connected with the steersman's wheel. By keeping the driving wheels behind instead of in front, as in the engines previously described, the greatest bite was obtained in ascending inclines and going over soft places. Besides being capable of hauling trucks, this engine was furnished with a fly-wheel, and could be used for driving a Blake's stone-breaker, or any other machinery connected with road-making. The weight of the engine was about 8 tons, and the nominal power 5 h.p.

In Paris the "Gellerat" system of steam roller had been employed, which differed materially from that designed by Mr. Aveling, in the position of the rollers; they were 3 ft. 11 in. in diameter and 4 ft. 7 in. wide, and placed under the frame upon which the boiler was supported, and connected to the engine, which was placed on the top of the boiler by means of pitched chains. On the side of the engine where the attachment was made with the crank shaft, the axles turned in radial boxes, fixed to horn plates, similar to an ordinary locomotive, whilst on the other side the axle boxes were free to move backwards and forwards, sliding on the frame of the engine, and connected together by a rod, with a male and female screw, worked from the foot plate by a vertical shaft, connected by bevel wheels with the steersman's handle. When the engine moved in a straight line the axles were kept parallel, but when necessary to turn a corner the centres on one side were drawn together, and, consequently, the rollers acted like a double steering wheel, turning the engine in a very small space.

From the reports of the Road Surveyors in Paris, it appeared that the cost of steam road rolling was estimated at 7d. per ton per mile; whilst horse rolling was usually contracted for at the rate of 14d. per ton per mile.

[This paper will be concluded in our next.]

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THE INVENTORS' INSTITUTE,

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Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868.

LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES

THURSDAY, MAY 8th.—Patent Law Meeting.

THURSDAY, MAY 22nd.—General Meeting at 4 o'clock p.m.

Monthly Notices.

Deaths of Baron Liebig and Sir W. Tite—Appointment of Professor James Thomson, of Belfast, to chair of Engineering at Glasgow—Another human skeleton found at Mentone—Combustion of the Diamond without excessive heat—Anthropological Institute and Anthropological Society—Puddling oirn by gas from Blast Furnaces—A new indelible ink Report of Librarian of Radcliffe Library—Luminosity of Sea Water—Pliocene formation in Southern Italy—Utilization of air from the Diving Apparatus—Wood Paper at Bath—*Les Mondes*—*L'Institut*—Pre-historic remains near Madras—Mr. W. H. Johnson on effects of acid on iron and steel—M. Ch. Ekin on Sub-nitrate of Bismuth—Election of M. Janssen as Member of Académie des Sciences de Paris.

The deaths of Baron Liebig, the eminent chemist, and Sir W. Tite, the well-known architect, have been recently announced.

Professor James Thomson, LL.D., of Queen's College, Belfast, eminent for his quantitative calculation of the lowering of the freezing-point of water by pressure, has been appointed Professor of Engineering at Glasgow, to fill up the vacancy occasioned by the decease of the late Professor Macquorn Rankine. The new Professor is the brother of Sir William Thomson.

At Mentone another human skeleton has been found under similar circumstances to those in which human remains were discovered in a limestone cavern in that locality last year.

That excessive heat is not necessary for the combustion of the diamond seems not so certain as generally supposed. Mr. Spence, of Manchester, records that a South African "off-coloured" diamond, the size of a small pea, was embedded in fire-clay, mixed with carbonate of soda and hydrate of lime. This was placed in a crucible, and heated in a muffle, for three days and three nights; and though the temperature maintained was that of a low cherry heat, it was found on opening the mass that the diamond had disappeared.

We are sorry to learn that in consequence of a split-up in the Anthropological Institute, we are to have a London Anthropological Society as well as that Institute. Anthropology, though a most important branch of science, is unfortunately not so popular as to be in a position to support two organizations for its advancement. Rivalry may, it is true, stir up greater activity amongst the promoters of this science; indeed, it seems to be doing so already, since the Institute referred to is reported to have it in contemplation to hold some public and popular meetings, similar to those which were held at the Museum of Geology some years ago.

A description of the process of puddling iron by gas derived from blast furnaces where iron ore is smelted with wood charcoal, which was sometime since patented by M. de Langlade, and is now in operation in France, is published in the *Bulletin de la Société de l'Industrie Minerale*.

An indelible ink, which, it is said, does not prejudicially affect steel pens, is suggested by Dr. Bettger, in *Polytechnische Journal von Dingler*, to be made by rubbing down aniline black in a porcelain mortar with some drops of concentrated hydrochloric acid and alcohol, and afterwards mixing the same with a hot solution of gum arabic, and if this be replaced by shellac an enamel colour for wood or leather is produced.

In the report of the Librarian of the Radcliffe Library (Dr. H. W. Acland) it is suggested that that institution should be made more efficiently to reflect the progress of the higher scientific education. We hope the trustees of the Library will give every attention to the Doctor's advice. Scientific instruction is a great practical question of the day.

The *Athenæum*, in its Science Gossip, observes:—It has been long felt that it is most desirable to have some means of determining with approximate accuracy the per centage of light which penetrates any given depth of sea-water. Dr. Hill has devised a method which was used on board the *Hasler*, which carried Professor Agassiz's Expedition on the recent Coast Survey. The arrangement consisted of a strip of board about four inches wide, and four feet long, divided into a scale of ten equal intervals, and painted a dark lead colour at one end, fading into white at the other - a large white board being fastened parallel to it, at a measured distance below it. The relative whiteness of the boards, when this arrangement is sunk into the sea, is a measure of the per centage of light absorbed, while going down, and up again, through the distance by which the boards are separated.

In the first number of the *Bolletino del R. Comitato Geologico d'Italia* for the new year Prof. G. Seguenza commences an important memoir "On the Pliocene Formation in Southern Italy." This work, illustrated with plates and geological sections, will be continued in succeeding numbers.

M. J. D Pasteur, of Gennep, has found that the air escaping from the diving apparatus, although unfit for healthful respiration, will still maintain combustion. He has, therefore, constructed a lamp for burning under water, which is supplied with the air which has been used by the diver. The diver wears the lamp attached to his dress and, as it is provided with a parabolic reflector, and the combustion is well supported, the light given is sufficient to read small handwriting under a considerable depth of water.

The manufacture of paper from] wood is said to be being carried on with success near Bath.

Les Mondes, for April 3rd, publishes a 'Note relative à l'Observation du Passage de Vénus devant le Soleil au Moyen du Spectroscope," by Father A. Secchi, Director of the Observatory of the Roman College at Rome. Just now this is of considerable interest.

Some curious observations, "Sur la Coloration des Racines Aeriennes do Deux Orchidées," were communicated to the Société Philomathique de Paris, by M. A. Bertrand. This note is published in *L'Institut* of March 26th.

Some interesting discoveries of pre-historic remains near Bellary, in Madras, have recently been made by Mr. Fraser and Mr. Bruce Foot. In the neighbourhood of some large kitchen-middens, great numbers of celts, rubbing-stones and pounders, chiefly of greenstone, have already been found; and it is expected that a careful examination of the middens will yield an unusually rich harvest. One of the refuse heaps, composed of slag and midden-stuff, had previously been described as a volcanic ash-cone!

At the Literary and Philosophical Society of Manchester, some researches on acids in connection with iron and steel, by Mr. W. H. Johnson, showed that the effect of immersion in acid is to increase the weight of the metal and decrease its toughness.

M. Ch. Ekin, in the *Moniteur Scientifique Quesneville*, for February, states, that in many samples of sub-nitrate of bismuth which he examined he detected from 3·9 to 6·5 per cent. of subchloride of silver, and, in other samples, metallic silver in a finely-divided state, though in small quantity.

M. Janssen has been elected a member of the Académie des Sciences de Paris, in the section of Astronomy.

The Inventors' Institute.

At the meeting on April 10th, in the absence of Sir ANTONIO BRADY, Chairman of the Council, Mr. F. H. VARLEY, Member of Council, was voted to the chair. The meeting was, by special arrangement, devoted to the consideration of the action to be taken by the Institute in regard to the forthcoming International Patent Congress in Vienna.

The Chairman having stated that the object of the meeting was to ascertain the views of the members on the important question above referred to, called upon the Secretary, Mr. R. M. LATHAM, to open the discussion of the subject. This he did by stating that the present was a most critical time for inventors, for although, as he had informed the members of the Institute at a former meeting, the Crown Law Officers had stated to him that there was no intention on the part of the Government to attempt to legislate on the Patent Laws during the present Session, yet he had recently learnt that it was now an understood thing that the Lord Chancellor (Lord Selborne, better known as Sir Roundell Palmer) was to bring the subject before the House of Lords forthwith. As his lordship was well known to be a determined opponent of the Patent Laws, it was more than probable that any measure originated by him would be of such a character as to operate on the interests of inventors in an injurious manner. He (Mr. Latham) had, therefore, thought it right to place himself in communication with several well-known Members of Parliament, amongst others Mr. Hinde Palmer, Mr. J. Howard, and Mr. Mundella, who had agreed to come to a conference on the subject with the Council of the Institute on Saturday, the 26th inst., when he hoped all then present would attend. As to the immediate business of the present meeting he would suggest that it had three aspects—(1) The desirability of the Inventors' Institute being represented at the proposed Patent Congress at Vienna; (2) The fit and proper persons to represent the Institute; (3) The instructions to be given to such persons. With regard to the first point he thought all present would agree with him in thinking it most desirable that the Inventors' Institute should be represented at the forthcoming International Patent Congress. As to the second point, he had to state that a well-known member of the Council (Dr. R. H. Collyer), who was going to Vienna as one of the exhibitors, had offered to represent the Institute free of cost, and he need hardly say that Dr. Collyer was well fitted to carry out the duties of the office in an efficient manner. As to the instructions to be given to the representative of the Institute, he felt considerable diffidence in offering any opinion whatever, for, as far as he was aware, the Inventors' Institute had, up to the present moment, never given the subject of International Patent Law any serious consideration, but he would suggest that the question could be settled on the basis that when an inventor had taken out his patent in his own country, it should be *ipso facto* taken out in all countries, subject to the International Patent Law compact, but that all international patents should be subject to the right of any manufacturer to use the patented invention on payment of a royalty of ascertainable amount. In other words, that they should be subjected to what had been termed the compulsory licence system. If the patent laws of all countries could be rendered uniform, that would be a great point gained, provided the law be similar to the Invention Right Bill, prepared by the Inventor's Institute, and the representative of the Inventors' Institute ought not to lose sight of this.

Mr. J. M. HYDE said that the question before the meeting was one of a very grave and important character. He had had great experience in patent matters as an inventor and as a manufacturer, and the result he had now arrived at was, that to attempt to maintain the present position of the inventor as regards his power to shut up his invention against the manufacturers, could not be permanently sustained. He, therefore, considered Mr. Latham's suggestion sound, practicable, and politic, as it would enable the inventor to give way on this point with a good grace; since, as Mr. Latham had aptly remarked, although he gave up some of his privileges, he was to get something very valuable in exchange, namely, an international patent right instead of a merely national one.

Mr. BLANCHETT thought that this subject would have to be very carefully handled at the Conference if any practical good were to result. He was clearly of opinion that the right course would be to settle some general questions, such as those which Mr. Latham had dealt with, and in other respects to leave each country to keep its patent laws in any form it might think desirable. He feared that any attempt to make the patent laws of every country uniform would end in failure.

Mr. F. W. CAMPIN said that he thought Mr. Latham's suggestion was a most valuable one, but, at the same time, before the Inventors' Institute agreed to affirm it, he considered they ought to carefully discuss the effect it might possibly have on the position of a large number of inventors, whose history was of this character,—that when first they sought to introduce their inventions to the public no manufacturer would listen to them, but after they had been able by great perseverance, and considerable outlay, to place the invention in the market, then the manufacturers wanted to have licences which would enable them to destroy the inventor's personal trade, leaving him to depend upon royalties alone; and royalties, it must be remembered, were subject to various difficulties as to estimation and as to collection. Still, he thought compulsory royalties would cut away many of the economist objections to the patent system. To be on the side of caution, he would suggest that in an international system, in the country originating the patent, compulsory licences should not be enforced, at all events, not until half the patent term was completed, and that the licence rate in other countries should not be so low-priced as to enable the licensees there to compete unfairly with the patentee and his licensees in the originating country. With regard to the appointment of Dr. R. H. Collyer as the representative of the Institute at the Vienna Patent Congress, as himself an old member of the Institute he had had many opportunities of knowing Dr. Collyer's worth, and he should have much pleasure in supporting his appointment.

Mr. MURRAY argued strongly against compulsory licences in any shape or form. His experience proved that inventors would be guilty of the most absurd folly in sanctioning such a system.

Mr. TOOTH argued in favour of the system proposed by Mr. Latham, at the same time what had fallen from Mr. Campin impressed him with the idea that the matter ought to be postponed for further consideration.

After some explanatory remarks by Mr. Latham, and by Mr. Campin on the subject of the terms of various foreign patent laws now in operation, and a few words from Mr. GUILE, who stated that he was there to assist the meeting with any suggestions on behalf of the working classes, amongst whom were many men of ingenuity, and speaking in their interest, and as it seemed to him in the interest of the majority of inventors of other classes also, he must say that international patent rights, cheaply obtainable, and open to be used by all manufacturers at ascertained rates of licence money, which it must be remembered would, as Mr. Latham had very properly intimated, act as an invitation to manufacturers to adopt new inventions, be a great boon not only to the particular individuals in the working classes he had named, but to the whole body of working people as well, and he was sure it would greatly benefit everybody irrespective of class.

The CHAIRMAN ably summarised the various statements and arguments which had been presented to the meeting, and then remarked that he had been requested to allow three resolutions to be put to the meeting. The first was:—"That one or more honorary commissioners be appointed to represent this Institution at the forthcoming Patent Congress at the Vienna International Exhibition." This was moved by Mr. Murray, seconded by Mr. Blanchett, put, and carried unanimously.

The second resolution was:—"That Robert Hanham Collyer, M.D., F.C.S., &c., be, and is hereby appointed, one honorary commissioner to represent the Inventors' Institute at the forthcoming International Patent Congress to be held in Vienna in 1873." Proposed by Mr. F. W. Campin, seconded by J. M. Hyde. This resolution, also, was put and carried unanimously.

The third resolution:—"That the drafting of the instructions to be forwarded to the honorary commissioner, or commissioners, be postponed till after the Conference arranged to be held on the 26th inst. has taken place." This resolution being proposed by Mr. R. M. Latham, and seconded by Mr. Murray, was likewise put and carried unanimously, and, with a vote of thanks to the chairman, the proceedings terminated.

ANDERSON'S EQUILIBRIO CABIN.

THIS cabin maintains a vertical position when the ship rolls by means of wheels resting on concave rails, whereby it gravitates to the lowest level by its own weight (aided if necessary by ballast placed in a receptacle for that purpose under the flooring), it is guided and preserved in its proper position, centrally over the keel, by pivots fixed to the bulkheads of the recess in which it is placed, which work in vertical grooves attached to the cabin, the latter is thereby prevented from lateral and also from fore and aft movement, and maintained steadily upon its wheels without undue restraint in a vertical direction; the wheels have springs upon their axles to modify the upward and downward motion of the ship, and another purpose of the vertical grooves upon the cabin (in place of sockets) is to allow of free action to the springs.

Access to the cabin is obtained by a doorway immediately over the centre of motion in front of which is attached a stage or platform, with a gangway platform hinged on either side of it, the other end of which has rollers or runners resting on the deck these platforms give to the motion of the ship and maintain easy communication with the fixed stage at the entrance of the cabin a flight of stairs leads from the doorway to the flooring.

In the interior, couches are placed along the sides parallel with the keel, which retain a horizontal position when the ship pitches by means of flanged wheels running upon curved rails attached to a suitable frame with a clip or catch to retain them on the rails; similar seats may also be placed on the roof, which is reached by stairs from the interior.

The cabin may be constructed of any dimensions, and being self-acting, can be applied to ships making either short or long voyages.

An illustrated description of this cabin and its fittings can be obtained of Messrs Mitchell, 39, Charing Cross.

Proceedings of Societies.

ROYAL SOCIETY.

March 20.—G. Busk, V.P., in the chair.—The following papers were read:—"On the Distribution of Invertebrata in relation to the Theory of Evolution," by J. D. Macdonald,—"On the Temperature at which Bacteria, Vibriones, and their supposed Germs are killed when immersed in the Fluids or exposed to Heat in a moist State," by Dr. Bastian,—and "Some new Theorems on the Motion of a Body about a fixed Point," by Mr. E. J. Routh.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

Tuesday, April 1, 1873.—Dr. Birch, F.S.A., F.R.S.L., President, in the chair. The following candidates were duly elected Members of the Society:—Rev. William Bramley Moore, M.A.; Rev. Henry Geo. Tomkins. On the recommendation of the Council, and at the request of Mr. Bonomi (acting on their behalf), the surviving Members of the Anglo-Biblical Institute, the Chronological Institute, the Palestine Archæological Association, and the Syro-Egyptian Society, together with their respective libraries and effects, were unanimously incorporated with this Society. The following papers were then read:—1. "On the Religious Belief of the Assyrians," Part III. By Henry Fox Talbot, Esq., D.C.L., F.R.S.—In this paper the learned philologist continued to point out the great similarity which exists between the Biblical and Assyrian styles of writing and expression, illustrating these under the sections of Self-Mutilation, Prostration before superiors, Talismanic Charms, Magical Numbers, Phylacteries, the use of the Mamit, Demoniacal Possession, the Sacred Number Seven (illustrated by the Song of the Seven Spirits, translated from cuneiform texts), &c.; some further observations on the use of the Mamit as a charm, which was to be wrapped in a cloth around the temples of a dying man to expel evil spirits, and some exegetical remarks concluded this very valuable and interesting paper. 2. "On the Identification of Nimrod, from the Assyrian Inscriptions." By Rev. A. H. Sayce, M.A.—In this paper the learned author stated that all the evidence which is at present available, would identify the hero Nimrod with the deity Merodach; on these grounds, 1st, the relation of Assur and Babylon to Nimrod in the Bible, and to Merodach in the inscriptions being the same. 2nd, Merodach being regarded as a hunter, accompanied with divine dogs; and 3rd, Nimrod being identical with the Accadian form of the name Merodach, who is called also in the cuneiform inscriptions "the hero," or "mighty man." 3. "On an Ancient Triple Synchronism - Egyptian, Phœnic-Assyrian, and Greek." By Rev Basil H. Cooper.—Taking for his starting-point a hieroglyphical tablet which was found a few years ago on the site of Harvaris, the Lower Egyptian stronghold of the Hyksbos or Shepherd Kings, dated in the 400th year of an Era, counted from the accession of a king named Sethos or Zethos, whom Mr. C. identified with the founder of Manetho's Seventeenth Dynasty which is stated to have been Phœnician. By the combined testimony of Conon and Manetho, he proved that this Phœnician dynasty made Egyptian Thebes its capital, and held it for 43 years. Thence it is said to have overrun Asia, and to have planted Thebes in Greece. This latter fact was the historical germ of the myths of Cadmus on the one hand, and of Amphion and Zethos on the other, the divine twins whom Homer makes the founders of Bœotian Thebes. "Cadmus is simply the Phœnician word for "the East," just as in the name of his sister Europa we have the Phœnician word Ereb "the West," so ingeniously turned into Greek that in that language it denotes literally "the East-facing (land.)" The Homeric legend or *ama* is of a more mythological cast. Amphion, "the Beneficent One," is one of the most sacred names of Osiris, and the lyre with which it is invariably written reminds us at once of the lyre to whose music the walls of the Cadmeia spontaneously arose. Osaris, as Diodorus tells us, was in the Egyptian tradition the founder of the Nilotic metropolis of the Greek city. The twin brother of Osaris was the god Zethos, after whom the Phœnician Pharaoh, as well as several subsequent native ones, *e.g.*, the greater father of Ramses the Great, or Sesostris, were named, and in whose temple at Havaris the 400 year Stela was found. The fact that the Phœnician Pharaoh Sethos was really lord of the East, was proved by the occurrence of his name in Ctesias's list of the kings of Assyria with a reign of just the same length as assigned to the Hyksbos Sethos and beginning in the same year. Accordingly his name in cuneiform is met with on a trapezoidal ... cylinder in the British Museum and the hieroglyphical legend enclosed in a Pharaonic ring is engraven on the breast of a lion in grey granite, which was found at Bagdad and is now in a private collection at Paris.

CHEMICAL SOCIETY

March 20.—Dr. Frankland, President, in the chair.—Mr. C. W. Siemens delivered his lecture "On Iron and Steel." The lecturer, after adverting to his former discourse, delivered before the Society in 1868, and describing the various experiments he had made to obtain malleable iron direct from the ore, gave an account of the process by which he had succeeded in completely attaining that object. It consists, essentially, in fusing the ore by means of the most intense heat in a revolving furnace, and then adding the requisite amount of carbonaceous matter to reduce the iron to the metallic state. The malleable iron, thus precipitated in the molten mass, becomes aggregated into balls by the revolution of the furnace, and can then be easily removed. It is free from sulphur, phosphorus and other impurities, and dissolves readily in a bath of molten cast iron, producing steel equal to that made from the best Swedish bar iron.

ZOOLOGICAL SOCIETY

March 18.—The Viscount Walden, F.R.S., President, in the chair. The Secretary read a report on the additions to the Society's Menagerie during the month of February. Amongst them was especially noticed a Red Tiger-Cat (*Felis aurata*, from the Gold Coast, presented to the Society by Mr. C. S. Salmon.—A communication was read from Mr. R. B. Watson on some marine Mollusca from Madeira including a new genus of the *Muricidæ*, proposed to be called *Chascax* and a new *Rissoina*, and embracing descriptions of the whole of the *Rissoa* of the group of islands.—A communication was read from Dr. J. D. Macdonald, F.R.S., on a specimen of *Acanthias vulgaris* and a species of *Galeus*, probably new to science, taken off Flinder's Island, Bass' Straits.—Mr. W. T. Blanford read a paper on the Gazelles of India and Persia. This contained the description of a new species *Gazella fuscifrons*, founded on a single specimen obtained by the author in 1872, near the edge of the desert of Seistan.—A communication was read from Dr. J. S. Bowerbank, F.R.S., containing the fifth part of a series of memoirs entitled Contributions to a General History of the Spongiadæ.—A communication was read from Mr. Herbert Druce, F.Z.S., giving a list of the collections of Diurnal Lepidoptera made by Mr. Lowe, in Borneo, with descriptions of new species. A communication was read from Mr. Gerald Krefft, C.M.Z.S., containing the description of a new species of Crocodile from Queensland, proposed to be called *Crocodilus johnsoni*.—Mr. Edward Bartlett exhibited and gave the description of a new Moth belonging to the family Saturnidæ, which had been obtained in the interior of Madagascar by Mr. T. Waters, and which was proposed to be called *Tropæa madagascariensis*.

April 1st, 1873.—R. Hudson, Esq., F.R.S., Vice-president, in the chair. A communication was read from Dr. J. S. Bowerbank containing a description of the brain and of a portion of the nervous system of *Pediculus capitis*. A communication was read by Dr. J. E. Gray, F.R.S., containing remarks on the genera of Turtles (*Oiacopodes*) and especially on their skeletons and skulls. A second communication from Dr. Gray contained the description of the skull of *Sternothaerus*. Dr. A. Gunther, F.R.S., read descriptions of three new species of flying squirrels, proposed to be called *Pteromys tephromelas*, from Penang, *P. phæomelas*, from Borneo, and *Sciuropterus pulverulentus*, from Penang and Malacca. A communication was read from Mr. R. Swinhoe, H.B.M. Consul, Ningpo, on a Scaup duck found in China, which he referred to *Fulix mariloides* (Vigors). Mr. R. B. Sharpe, F.Z.S., read a paper on the *Falco arcticus* of Holboell, to which were added remarks on the changes of plumage in some other accipitrine birds. Mr. A. G. Butler, F.Z.S., communicated a list of the species of spiders of the genus *Acrosoma*, with descriptions of new species. M. O. Salvin made some remarks on the tail-feathers of the birds of the genus *Momotus*, and on the mode in which their peculiar form had originally arisen. The next meeting of the Society for scientific business will be held at the Society's House, in Hanover-square, on Tuesday, the 6th of May, 1873, at half-past eight o'clock, p.m., when the following communications will be made:—1. Rev. O. P. Cambridge.—On some new species of Araneidea. (Received 15th March, 1873.) 2. Sir Victor Brooke, Bart.—On African Buffaloes. (Received 18th March, 1873.)

GEOGRAPHICAL SOCIETY.

March 24.—Major-General Sir H. C. Rawlinson, President, in the chair.—The following new Fellows were elected:—Capt. H. Busk, Major A. Cathcart, Messrs. R. Galsworthy, H. Hill, A. B. Mitford, G. B. Tipping, H. Wagner, and J. Wonnacott.—The paper read was, "Notes on Khiva, and the Routes leading to that Country," by the President. Khiva, the tract of country south of Lake Aral, fertilized by the Delta channels of the Oxus, was probably one of the earliest settlements of the Aryan race. It seems also to have been the true cradle of Eastern Asiatic science, the date 1304 B.C., claimed by a native scholar for the people of Kharism, according with the date of invention of the Median calendar. It is probable that the invention of a lunar as well as a solar zodiac arose in the same ancient country, and passed thence to China and India. A curious feature in the physical geography of the region is the fluctuation which has taken place in the lower course of the Oxus, the river at one epoch flowing to the Caspian, and at another to the Aral. The stream was gradually deflected from the Caspian to the Aral during the fifth and sixth centuries of our era; and there exists an historical notice of the sea of Kadar, above Urganj, which was fed by the Caspian branch of the Oxus, drying up in the sixth century. From 500 to 1220 A.D., during which the river flowed, as now, into the Aral, the Caspian became, to some extent, desiccated, its waters retiring for a long distance on its eastern shore. After the latter date the river again changed its course into the Caspian, and several fertile districts on the eastern shore of the sea became thereupon submerged. This lasted for 350 years. Between 1575 and 1675 the river again reverted to the Aral, since which no similar alteration has occurred. Regarding the Russian project of

again diverting the Oxus waters to the Caspian, and thus creating an uninterrupted water-navigation, *viâ* the Volga and its canals, the Caspian, and the Oxus, from St. Petersburg to Afghanistan, the author quoted passages from the work of a recent Russian engineer, showing that though the diversion was practicable, it was impossible that the stream could be a navigable one. The Oxus is a rapidly flowing stream (five to six miles an hour), and silt rapidly accumulates in its canals and side-channels, needing an immense number of labourers to clear them annually. The present population is insufficient for these requirements, notwithstanding that the labour of Persian slaves is employed. In the event of her taking possession of the country, one of Russia's greatest difficulties would be the want of labouring population. The principal roads leading across the vast deserts which surround Khiva were, first, along the western side of the Ural, second, along the eastern side, from Fort No. 1 on the Jaxartes, third, another road a little further east, fourth, from Samarcand and Bokhara; fifth, from Merv; sixth, from the mouth of the Attrek; and, seventh, from Krasnovodsk, on the eastern shore of the Caspian.

ASTRONOMICAL SOCIETY.

MARCH 14.—Prof. Cayley, President, in the chair.—Messrs. J. M'Landsborough and E. B. Knobel were elected Fellows.—The following communications were announced and partly read:—"Meteoric Shower, November 27th, 1872," by Mr. Graham, Capt. Chimmo, and Mr. Forbes,—"New Use of the Altazimuth Diagram," by the Rev. A. Freeman,—"Markings on Venus," by Mr. Wilson,—"On an Instance of Abnormal Refraction," by the Rev. J. Slater,—"On the Eclipses mentioned in the Saxon Chronicle," by the Rev. S. J. Johnson,—"Phenomenon observed at Sea," by Capt Knevitt,—"On Meridian Marks for Transit Instruments," by Mr. Crossley,—"On the Barometric Error of Clocks," by Messrs. Webster and Denison,—"On Mr. Denison's Compensation for Ditto," by the Rev. Dr. Robinson,—"On the Want of Observations of Jupiter's first Satellite from 1868 to 1872," by Sir G. B. Airy,—"Discovery of Minor Planet 124," by Dr C. H. J. Peters,—"On the N. A. Values of the Semidiameter of the Sun and Venus in the Calculations of the Transit of Venus," by Mr. Dunkin,—Comparison of the R A and N.P.D. of Standard Stars observed at Oxford, with Places founded on the 'Tabulæ reductionum,'" by Dr. Wolfers,—"On the approaching Re-appearance of Biorsen's Comet," and "On the State of Calculations respecting Biéla's Comet," by Mr. Hind,—"Sweeping Ephemerides for Tempel's Comet," by Mr. Bishop,—"A Self-Recording Transit Micrometer," by Rev. S. Perry,—"On the Apparent Projection of Stars on the Moon's Disc," by Mr. Plummer,—"Copy of a Letter from the Astronomer-Royal to the Lords of the Admiralty on the approaching Transit of Venus," by Sir G. B. Airy,—"Observations of Venus collected by the Observing Astronomical Society," by Mr. Denning.—"Ephemeris for Physical Observations of the Moon," by Mr. Marsh,—"The Transit of Venus," 1874, by Mr. Proctor,—"Distribution of Resolvable and Irresolvable Nebulæ," by Mr Waters,—and Re-discovery of Biéla's Comet, No. 2," by Capt. Tupman.

METEOROLOGICAL SOCIETY.

MARCH 19.—Dr. Tripe, President, in the chair.—Admiral Sir E. Belcher, Messrs. W. F. Denning, E. M. Eaton, R. J. Lecky, J. Rickett, A. Slate, and L. Turtle, were elected Fellows.—Mr. R. H. Scott read a paper "On some Results of Weather Telegraphy." He stated that the information received was insufficient, both in quantity and quality, to give a complete idea of the weather, and showed how any serious extension of the system would entail greatly increased expenditure, citing the very large cost (£50,000 per annum) of the American Signal Service, the most perfect in existence. He drew attention to the frequency of telegraphic errors, and the serious results arising therefrom. He next proceeded to discuss the probability of our deriving benefit from additional reports from Azores, &c., and showed, by actual investigation, that such reports would not be of immediate use to these islands in regard of giving notice of advancing storms. The modes of conveying warnings to ships were next mentioned, and Mr. Scott stated his belief that ultimately Admiral FitzRoy's drum and cones would be adopted, though not, perhaps, with the significations originally attached to them. The results of the comparison of warnings issued with the gales experienced during the past three years was finally given, and it was shown that while in 1870 and 1871 the percentages of success had amounted to 68 and 63 respectively, in the year 1872 this figure had risen to 81 per cent., as 61 per cent. of the warnings had been followed by gales, and 20 per cent. by strong winds, amounting to a slight gale.—Mr Marriott read a paper "On the Barometric Depression of January 24th, 1872." This depression occurring in the early morning hours, very few observations had been made, but from those at his command, it seemed to have first touched the English coast, near Falmouth, about midnight, and to have passed along the coast to Upwey, which was reached about 3 a m.; it then took a northerly course, reaching Birmingham by 6 a.m.; after which, its path was over Derbyshire, Nottinghamshire, and Lincolnshire, and it then passed out of the river Humber between 10 and 11 a.m. Mr. Marriott stated, however, that the evidence was insufficient to prove that this was its actual path, or whether it merely passed over England in a north-east by north direction, at a uniform rate of about 30 miles an hour. The lowest readings of the barometer observed were 28.18 in. at 4.30 a m at Clifton, and 28.179 in. at 5.20 a.m. at Evesham. The paper, which was accompanied with charts giving the isobars for each hour, concluded with a few remarks on former depressions.

THE INSTITUTION OF CIVIL ENGINEERS.

MARCH 25th, 1873.—T. Hawksley, Esq., President, in the chair. The paper read was on "The Mont Cenis Tunnel," by Mr. Thomas Sopwith, Jun., M. Inst. C.E. This communication might be considered as supplementary to a former paper read in 1864—(Min. Proc. Inst. C.E., vol. xxiii., p. 258)—and described, 1. The tunnel, as completed, with statistics obtained either by actual observation or from the engineers in charge, or from official publications of the Italian Government. 2. The principal changes which had been introduced in the works and machinery underground and at the surface since the summer of 1863. In the summer of 1863, when the works had been 5½ years in progress, about 1-5th of the entire length had been pierced; 7½ years afterwards, at the end of 1870, or about 13 years, dating from the commencement of the works, the entire distance had been traversed. With regard to the tunnel as completed. The advancing gallery from the Bardonnèche, Italian or southern end, was connected with that from the Modane or French end of the tunnel by a bore hole, 3 metres 80 centimetres long, at 4.25 p.m., December, 25th, 1870. The diaphragm of rock was shot away by 5.20 p.m. the following day (Italian time), and Mr. Copello, the engineer in charge at Modane, past from end to end of the tunnel, entering at the French and coming out at the Italian end. There was an error of about 1 foot in level at the meeting of the two galleries, but no appreciable error in direction.

The actual length of the tunnel was 12,233 metres 55 centimetres (7·6017 miles), or about 15 yards more than was previously stated by the author. The following data, which were now accepted as correct, also varied from those he stated previously:—

Modane or north entrance is 3,801 ft. above level of sea; Bardonnèche or south entrance 4,236; summit of tunnel 4,246; summit of section over tunnel 9,527.

There were curved tunnel entrances at each end, which, added to the length of the real tunnel, made the length traversed by the trains 12,840·92 metres, or 7·9806 miles.

In the total length of the tunnel proper (12,233·55 metres), counting from the Modane or northern end southward, the following different rocks were traversed:—

Carbonaceous Schist 2,096·50 metres; Quartz 388·50; Limestone and Dolomite Limestone 355·60, Calcareous Schist 3,392·95; Total metres 12,233 55.

It was expected that the difference of level (435 ft.) between the French and the Italian extremities of the tunnel, would have insured under all circumstances a steady current of fresh air from north to south; but this had not been the case. The ventilation, although not bad enough to incommode passengers, or to impede the present traffic, was such as to render the work of watchmen, rail-layers and others employed in the tunnel, insupportable at times, and with increased traffic, serious difficulty might be experienced. A remedy was being applied by laying a pipe (20 cents.) 8 in. diameter, from end to end of the tunnel, midway between the two lines of rails which would be supplied with compressed air from the Italian end, and which would have cocks at short intervals opened as occasion requires, by the men at work in the tunnel. Shelter places, or niches, 1½ metre broad by 1 metre deep, were provided at the Bardonnèche end, at distances of 50 metres, alternately on the two sides, and at the Modane end in like manner, at distances of 25 metres. At each 1,000 metres there was a lamp-room, 3 metres square. The tunnel was walled, with the exception of about 300 yards on the French side; the side walls were 8½ ft. high, and of stone throughout, the arch on the Italian side was principally constructed of brick, and on the French side of stone; a brick key was used throughout. There are good side paths of flagged stones, 20 in. broad.

Assuming that the conditions as to temperature at Mont Cenis were not materially altered by its elevation above sea-level, and taking a mean of 2 deg. Fahr. as the increase of temperature for each 100 ft., the temperature in the tunnel should be 100 deg. Fahr. higher than what would be observed in a pit sunk from the summit of the section to a depth of about 80 ft. The author believed that the mean temperature which would have been observed in such a pit, if it had been sunk, would have been 50 deg. to 60 deg. Fahr. If these premises were correct, the temperature in the middle of tunnel should have been 150 to 160 deg. Fahr. The temperature of the tunnel was found to be less than was anticipated; that of the rock in the middle, and of springs issuing from it not having exceeded 84 deg. Fahr.

The temperature of the air in the tunnel during the progress of the works varied considerably according to the number of men employed, quantity of gunpowder consumed, and quantity of compressed air supplied. Extracts from observations of temperature kept at Bardonnèche, at different distances from the entrance, were given, and it was stated that, since the completion of the tunnel the temperature of the air had varied from 80 deg. to 90 deg. Fahr.

The author showed by tables the rate of progress made in each year in the galleries from each end, by hand labour and by machine. The greatest progress made in any one month, was in May, 1865, when 333½ ft. were driven, and the least progress,

after the successful application of the boring machines, was in April, 1866, when 35 ft. (in quartz) only were driven; both of these statements had reference to the Modane end. Better progress has been made at the Italian than at the French end of the tunnel, partly owing to the rocks being more favourable, and partly to the advanced gallery being one of a smaller size.

The cost was not yet known officially; it was supposed, however, to have been about £3,000,000. The author gave in his former paper extracts from the agreement entered into between France and Italy, May 7th, 1862, and an estimate of probable amount which would be due from France to Italy, the Government of the latter country having undertaken the completion of the tunnel. If the conditions of the agreement had not been altered, that estimate (£1,287,200) would be about correct, and should represent approximately the amount to be received by Italy from France, to which, add £520,000 to be paid by the Victor Emmanuel Railway Company; deducting this total, £1,807,200 from the supposed cost, or £3,000,000, the cost to the Italian Government appeared to have been £1,192,800, from which should be further deducted the value of plant, which would probably be turned to useful account in the construction of other tunnels. On December, 21st, 1867, the Italian Government sublet to Messrs. Sommeiller and Grattoni the excavation of the remainder of the tunnel, 4386·90 metres, at the price of 4,617 francs (£184 5s. 6d.) per lineal metre of completed tunnel.

The following changes had been introduced in the conduct of the works since 1864. In June, 1863, when 1,092·25 metres had been driven from the north, and 1,450 metres from the south end, there were no means actually adopted for ventilation, further than the admission of compressed air by means of cocks, from the supply-pipe, and from that afforded by the large quantity of air exhausted from the perforators in the forehead of the advanced gallery. In 1864 a brattice was placed from each entrance, dividing the tunnel horizontally, as far as the walling of the tunnel was completed, the air from the entrance passing along the under side, and returning along the upper side. At Bardonnèche the draft was stimulated by the return air being taken up in a conduit to a chimney, the top of which was not less than 300 ft. above the level of the tunnel; this being found insufficient, a fan about 32 ft. in diameter, was successfully used to stimulate the draught. At the north end it was found necessary to apply powerful exhausting pumps to extract the vitiated air. By their means fair ventilation was obtained during the prosecution of the works.

Hand labour was found insufficient for the enlargement of the advanced gallery. It was found also insufficient to carry away the rock extracted. In 1868, therefore, the machine perforators were applied for this purpose, at an increased cost as compared with manual labour, but with great success in advancing the rate of progress. Water column compressors were used at first, but the breakages being frequent and the duty performed unsatisfactory, pumps worked by water power were substituted, and gave excellent results up to the time the works were completed.

The alterations made since 1864 in the "perforators," were described. They were simpler in construction, better balanced, and require less repairs than formerly.

The principal dimensions of the perforator now in use were nearly as follows:—

MOTOR.—Diameter of piston 2·638 in.; area 5·4556 sq. in.; effective pressure, deducting back pressure 69 lbs. the sq. in.; length of stroke 2·834 in., equal 0·236 foot.

PERCUSSION CYLINDER. — Diameter of piston 3 in.; area 7·068 sq. in.; effective area, deducting annular space or counter pressure 4·374 sq. in.; average length of stroke 8 in., equal 0·666 foot.

Supposing the percussion machine to make 250 strokes per minute (or the motor 250 revolutions), the power developed is 1·35 h.p. in the latter and 2·46 h.p. in the percussion cylinder, and the quantity of compressed air amounted to 12·662 cubic feet per minute.

The author had not obtained information on the duty performed by the compressors; it is probable, however, the production of 12·662 cubic feet of air compressed to 6 atmospheres, or 5 above atmospheric pressure would require, with good machinery, about 14 h.p.

The different operations of boring, charging, firing, and removing the rubbish were, in the last two or three years, performed with great celerity, and three complete shifts or repetitions of each operation were worked in 24 hours. The strong doors formerly employed, fixed from 100 to 150 metres from the forehead of the gallery, and removed from time to time as it advanced, behind which the frame carrying the set of perforators was removed previous to the explosion of the holes bored, were suppressed, and the saving of time thus obtained more than compensated the occasional damage done by loose pieces of rock which came in contact with the machinery. The author was informed by the *employés*, that supposing 20 perforators were required for the current work, a stock of 80 was sufficient to insure at all times a supply of them in thorough repair.

Upwards of 4,000 men were latterly employed.

Notwithstanding the great cost which was said to have attended the construction of this great work, amounting, if the total figure of £3,000,000 were correct, to £206 per lineal yard, there was reason to suppose that, with the experience now acquired, a similar work could be performed at a cost of £100 per yard.

The time occupied in passing through the tunnel by the train was about 25 minutes.

At the ballot of March 4, 1873, the following candidates were declared duly elected:—Messrs. J. Bennett, G. J. H. Glinn, and R. Harris as Members; and Messrs. J. Barker, T. H. Blakesley, Stud. Inst. C.E., P. Carpenter, S. B. Darwin, E. Giles, F. W. Joseph, Lieut. R.S.C., W. H. King, Stud. Inst. C.E., C. E. Nicholas, F. J. Odling, Stud. Inst. C.E., A. Ricketts, R. E. Speakman, T. S. Stooke, G. Thompson, Colonel J. S. Trevor, R.E., Messrs. J. Whittingham, and G. H. Wood, as Associates.

It was announced that the Council, acting under the provisions of the bye-laws, had transferred Mr. W. Francis from the class of Associate to that of Member; and had admitted Messrs. A. M. Heaton, T. G. Bond, F. F. Buckham, M. Martindale and E. Thompson as Students of the Institution.

At the Ballot of April 1, 1873, the following candidates were declared duly elected:—Mr. C. H. Beloe as a Member; and Messrs. C. B. Braham, Stud. Inst. C.E., R. Davis, F. Fitzjames, F. W. Hartley, T. F. Harvey, J. W. Hill, R. J. Hutton, T. F. Parkes, Stud. Inst. C.E., A. W. Parry, F. M. Pratt, J. S. Statter, and C. E. Ware, as Associates.

It was announced that the Council, acting under the provisions of the Bye Laws, had transferred Messrs. E. S. Curroy and T. W. Dodds from Associates to Members; and had admitted Messrs. F. C. de M. Cardozo, H. Gordon, J. M. Small, A. Stark, B. J. Thomas, C. H. Wilson, and J. P. Woodcock, as Students of the Institution.

INSTITUTION OF NAVAL ARCHITECTS.

SESSION, 1873.—The programme of proceeding of this Institution included (Thursday, April 3rd):—1. Annual Report of the Council. 2. Address by the President (Right Hon. Sir J. S. Pakington, Bart., M.P., and on papers—1. "The Unmasted Seagoing Ships, *Devastation, Thunderer, Fury*, and *Peter the Great*." By Nathaniel Barnaby, Esq., Chief Naval Architect of the Royal Navy, Member of Council. 2. "The Load-draught of Steamers." By W. W. Rundell, Esq., Secretary to the Liverpool Underwriters' Association, and to the Underwriters' Registry for Iron Vessels, Associate. 3. "On the Overloading of Steamers." By J. Wigham Richardson, Esq., Associate. 4. "An Investigation of various Proposals for fixing the Load-line of Vessels." By Edward Withy, Esq., Member. 5. "On a Case not provided for in the Admiralty Regulations for Preventing Collisions at Sea." By James R. Napier, Esq., F.R.S., Member of Council.

(EVENING MEETING.)

1. "On Auxiliary Power for Ocean Navigation." By Henry Claughton, Esq., Member. 2. "The Causes of the Racing of the Engines of Screw Steamers, investigated theoretically and by experiment." By Osborne Reynolds, Esq., M.A., Professor of Civil Engineering in Owen's College, Manchester. 3. "On a Non-radiating Steam Engine." By Thomas Moy, Esq., Associate. 4. "A new form of the Safety Valve." By W. Babington, Esq.

(FRIDAY, APRIL 4.)

1. "Description of an Instrument for Automatically Recording the Rolling of Ships." By William Froude, Esq., F.R.S., Vice-President. 2. "The Rig of Iron-clad War Ships." By H. D. P. Cunningham, Esq., R.N., Associate. 3. "On Vessels for the Channel Service." By John Grantham, Esq., Member of the Council. 4. "On Water-tight Bulkheads." By Laurence Hill, Esq., Associate. 5. "On Water and Fire-tight Compartments." By Thomas Moy, Esq., Associate.

(EVENING MEETING.)

1. "Remarks on the Theory of the Rudder." By Herr Victor Lutschaunig, Professor of Theoretical and Practical Shipbuilding in the Imperial and Royal Naval and Commercial Academy of Trieste, Member. 2. "On the Relation of Frame-space and Shift of Butts to the Butt-fastenings of the Skin-plating of Iron Ships." By W. H. White, Esq., Fellow and late Student of the Royal School of Naval Architecture and Marine Engineering, Member. 3. "A new Hydraulic Steering Gear." By John S. Gisborne, Esq. 4. "Memoir on the Experimental Study of Waves." By Monsieur Emil Bertin, Knight of the Legion of Honour, Secretary of the Society of Natural Science at Cherbourg. 5. "The Designing of Yachts." By C. B. van Denser, Esq., New York. 6. "The Resistance of Ships." By C. B. van Denser, Esq., New York. 7. "On Waves in Liquids." By the late W. J. M. Rankine, Esq., F.R.S., Associate Member of Council.

(SATURDAY, APRIL 5.)

1. "On Boat-lowering and Disengaging Apparatus." By F. J. Sweeting, Esq. 2. "On Lowering Boats at Sea." By Lieut. May, late E. I. Company's Service. 4. "On an Instrument for Extinguishing Fires in Ships." By James Paton, Esq., M.D. 5. "A Proposed Torpedo Catcher." By W. E. Seccombe, Esq., Examiner of Dockyard Work to the Admiralty, Member.

It is believed that the time is not far distant when pig-iron will be commonly brought as ballast by ships crossing from America to Great Britain; that a large trade of this kind would have commenced already had American politicians been more philosophical and less political; had they studied the first principles of Political Economy.—*Iron.*

IMPROVED STEERING APPARATUS.

Henry Edward Lester, of the Victoria Docks, in the county of Essex, master shipwright, has recently specified his patent for some important improvements in steering apparatus for vessels.

In suitable framework, mounted on an iron or other foundation plate, bolted to the deck of the vessel, either aft or amidships, or, if desired, both aft and amidships, he arranges a double chain drum, one chain coming from underneath the drum in one direction, the other from underneath the drum in the other direction.

Around the drum, preferably in the centre, between the two grooves in which the chains run, is a cog-wheel, into the upper edge of which take two or more small cog-wheels, the axles of which latter work in the same framework as that of the drum.

These two or more small cog-wheels take again into another cog-wheel mounted higher up in the framework, and this wheel is made large or small according to whether it is desired to revolve the drum quickly or slowly; said revolution being effected by means of the ordinary steering wheel or wheels fixed on the axle end or ends of the last-named cog-wheel.

The chains, after passing from the under side of the drum in opposite directions, are run on pulleys or sheaves to the tiller in the usual manner. A bell gong or similar alarum fixed on the framework of the apparatus is struck each time the rudder is amidships or perfectly straight. A cramp is fitted to the latter for the purpose of taking the above chains, which obviate the necessity of unshipping tiller for alterations.

By means of this improved double-action steering apparatus, it is possible to bring a vessel completely round in much less time and with less labour than heretofore.

E. C. C. SEWAGE PROCESS.

This method of utilizing the excrementative refuse of our towns has just been brought under our notice. It appears to be the subject of two patents, one for collecting and disinfecting urine and fecal matter separately, and the other for apparatus for extracting the valuable constituents of the same. The process may be briefly explained as follows:—Urine and fecal matter are collected separately by the E. C. C. container; the fecal matter, which is first deodorized at the closet by being covered at each operation with a mixture of sawdust and soot, is afterwards, on being removed to the works, mixed with a small quantity of coal tar, and passed through a disintegrating machine, and moulded into blocks or bricks, which, after being air-dried, are to be used as fuel at the works for the purpose of extracting the ammonia from the urine by means of heat and lime in an improved still or apparatus very similar to that used for the ammoniacal gas liquors. The effluent water from the boilers being freed from its ammonia, but still containing, with the refuse lime, other fertilising salts, is then filtered and run off in a perfectly innocuous state into the drains. By the above process not only is the remarkable heating power of fecal matter utilised by being burnt in a close and special furnace, but the fertilising salts are regained in the ash in a condensed and most soluble form. The ammonia, which is the most valuable constituent of urine, is, therefore, extracted by means of this artificial fuel composed of fecal matter, sawdust, soot, and coal tar, at a very reduced cost when compared with the ordinary evaporating process, and also that lately adopted by the Towns Manure Company. Theoretically, it is calculated that there is sufficient carbon, or heating power, in dried fecal matter to extract the whole of the ammonia produced by the liquid voidings of a general population, but even supposing that a small quantity of extra fuel be required, the saving in this important item will be immense. The whole process being conducted in hermetically closed apparatus, cannot give rise to unpleasant smells, and the basculi tilting seat for distributing the sawdust and soot, or fuel disinfectant at the closets, appears of a sufficiently simple construction to permit its being purchased and used by the lower class, a desideratum which the inventors of dry closets and commodes, with their weights, levers, and springs, have not sufficiently taken into consideration. The practical experience which the inventor, Mr F. Target, C.E., has had in sanitary engineering, promises well for the success of this remarkable scientific and ingenious plan by which the inexhaustible and fertilising produce of our large centres of population is to be condensed into a small volume.

RENSHAW'S IMPROVEMENTS IN RAILWAY BRAKES AND SIGNALLING APPARATUS.

This invention is one of great ingenuity and practical importance, mainly relating to the application of the partial vacuum produced by a steam jet supplied from the boiler of the locomotive attached to the train to retard or stop the motion of the several carriages by means of communicating pipes and suitable mechanism; also to the means of preventing the overheating of the brake blocks, when composed of metal, and, in addition, to a system of enclosed tubes or pipes applicable to intercommunication by signals between the guard, driver, and passengers.

In carrying out this invention the inventor fixes a pipe longitudinally on the top of each and every carriage to which his system of continuous brakes is to be applied, such arrangement of pipes being articulated and connected by means of buffer joints or flexible communications between the several carriages in such manner that a free passage for the air enclosed within such pipes is maintained throughout the train, the said joints or flexible communications being sufficiently air tight to allow of a partial vacuum being produced and kept within the said pipes at pleasure. This system of pipes communicates, and is in connection at the front end, with a steam jet supplied by the boiler of the locomotive, and also with a series of small cylinders, each having a suitable piston attached to a rod operating by means of lever gear the brake of its own carriage in such manner that when the steam jet is turned on by means of a cock or valve under the control of the driver, a partial vacuum is produced within the said system of pipes and cylinders with pistons, owing to the enclosed air being driven out by the issuing steam, and the said pistons are so forced into the said cylinders by the weight of the external atmosphere, and the connected brake mechanism is so operated as to apply the brake blocks to the wheels to retard or stop the train. And when cast iron, or other metallic brake blocks, are used, a cavity is formed within such blocks, and such cavity is placed in connection with a cistern or reservoir of cold water by means of flexible pipes or tubes, thereby causing a circulation of the said water when the said blocks become heated, and tending to keep them cool.

A system of automatic valves enables the brakes to be operated if a portion of the train becomes disconnected by failure of the ordinary couplings, and a smaller system of pipes or tubes may be carried within the aforesaid and larger series for the purposes of intercommunication by signals between the guard, driver, and passengers in such manner that the joints of the two systems may be connected and disconnected at the same time.

APPLICATIONS FOR PATENTS.

[Continued from Page 2.

neys.—W. R. Lake. Stay bolt for steam boilers (com. by J. Cochrane).—J. K. Tullis. Dressing leather and the machinery or apparatus employed therefor.—J. Wood. Axles and axle-boxes.—A. W. C. Williams. Machinery for manufacturing screws (com. by J. A. Ayres).—J. F. A. Gillon and P. J. Dujardin. Special arrangements of rolling mills with three cylinders.—R. Gigodot. Mode of and apparatus for ventilating furnaces of steam boilers.—A. M. Clark. Machine for sewing leather and other heavy fabrics (com. by J. Boyle).—D. Francis. A desk, a seat, and a table.

On March 20th.—1029 to 1050.—W. R. Jolley. Life rafts applicable to ships and other sea-going vessels.—T. Bevington. Improvements in gloves and in means or appliances for securing the cuff or end to the wrist.—J. W. Lea. Improvements in shirts and similar under-garments for gentlemen's wear.—W. Grange. Common road and tramway cars, and in the mode of applying the same.—R. Morris. Boots and shoes, and loose socks and clogs to be used therewith.—C. Stubbs. Apparatus for heating brine in the manufacture of salt.—F. Fleming and J. Milner. Apparatus for flattening or shaping wire to be used in the manufacture of wire cards and reed wires for looms for weaving.—H. A. Bonneville. Machinery for corking bottles (com. from J. A. de Mestre).—J. W. A. Taylor. Construction of fire-places specially adapted for economising fuel and diffusing heat.—A. T. Allcock. Rotatory wood-cutting machines for making laths, cards, strips, and sheets of wood.—A. Heaven. Manufacture of table-covers and covers for other articles of furniture.—E. Booth. Pin or pirn winding machines.—J. L. Clarke. Means and apparatus for fitting candles to candlesticks.—H. Jones. Cork life-belts for preserving life at sea.—N. Athow. Production of colours for dyeing, printing, and staining.—E. E. Pearse. Manufacture of glucose or grape sugar from rice and other grain, and in apparatus employed therein.—G. Spencer and W. M. Smith. Parts of locomotive engines, carriages, and waggons for railways and tramways, parts of which may be used for other purposes.—I. Baggs. Manufacture of gas for illuminating and other purposes.—H. H. Doty. Burners for railway and other lamps.—G. Beadon. Apparatus for saving life from drowning, which apparatus may be used for other purposes.—J. Thomas and H. L. Morris. Cleaning or finishing metal plates after they have been coated with tin or other metals or alloys.—T. C. Townsend. Machinery or apparatus for raising or lifting the permanent way of railways, and for lifting and pressing for various purposes (com. by L. C. B. Michel).—W. R. Lake. Apparatus for supplying locomotive tenders with water (com. by W. E. Prall).

On March 21st.—1,052 to 1,069.—J. H. Read. Pegging machines for pegging boots and shoes or similar articles. (Complete specification.)—J. Towlson. Machinery or apparatus for decorticating and cleaning grain.—J. W. Gray. Paving-blocks or flaggs (com. by C. F. Sebille).—P. Jensen. Manures (com. by E. J. Erichsen).—R. Young. Manufacture of shirts, fronts, and articles of a similar nature.—W. Morgan-Brown. Combination or permutation padlocks, either alone or in adaptation to locks of any usual construction (com. by H. Count von Seilern).—J. Wain. Mules for spinning and doubling.—T. H. Forrest. Steam pumps.—H. J. Fairchild. Pressure gauge (com. by J. W. Stiles).—H. Heinmann. Apparatus for utilizing the exhaust steam of steam engines.—L. Van Laak and J. Gillespie. Bungs and bung inserters.—G. B. Palmer. Ball valves.—W. E. Newton. Fog signals for railways (com. by F. D. Ruggieri).—D. Gilbert. Buttons.—E. W. Jobson. Apparatus for controlling the supply of water to water-closets, urinals, and such like places, and in effecting the measurement of the water supplied for such and other purposes.—I. L. Pulvermacher. Means of and appliances for the application of magnetism in connection with electricity for curative purposes.—M. Alex. Apparatus for lowering ships' boats.—F. Healy. Construction of machinery for raising and treating peat, and for the manufacture of the same into fuel.

On March 22nd.—1,070 to 1,078.—H. Martin. Manufacture of concrete and other bricks, by means of a machine worked on the lever principle, and arranged throughout so as not to be

costly in its construction.—R. W. Attwood. Hydraulic motive-power machine.—C. W. Harrison. Apparatus for charging or impregnating atmospheric air with the vapour of hydrocarbon liquids.—P. Jensen. Construction and arrangement of coke ovens, and of salt evaporating pans heated therefrom (com. by E. J. Erichsen and J. G. Maardt).—J. Nixon and J. Winterbotham. Rolling of steel used in the manufacture of blades for table knives, carving knives, bread knives, butchers' knives, spear knives, swords, matchets, and other such articles. —C. Parkinson. Machinery for beaming or warping yarn.—H. Bessemer. Apparatus to be employed on board ship for controlling, regulating, and indicating the motions of suspended saloons, floors, or platforms, applicable also for the discharge of marine artillery.

On March 24th.—1077 to 1091.—J. J. Myers. Method of removing and neutralizing noxious smells in dwelling-houses and other buildings arising from waterclosets, drains, dead wells, sewers, and sinks, by assisting the sewer gases therein to escape outside the buildings, and facilitating the ingress of atmospheric air into and for the purpose of ventilating the sewer pipes and their several connections.—T. Laycock and J. Shuttleworth. Construction of spools, reels, discs, and tubes for sewing machine shuttles, also the apparatus for winding the thread thereon. (Complete specification.)—D. Smith. Construction of railway permanent way. (Complete specification.)—H. Henkel. Breech-loading fire-arms (com. by Messieurs Dresse, Lalon, and Company).—M. Tobin. Improved means or mode of ventilating rooms or apartments, and the apparatus employed therefor, part of which invention provides a greater security against burglars. — T. P. Moorwood. Improved construction of domestic fire stove for economising fuel and producing a better radiation of heat.—W. Lawrence. Apparatus for cooling and for heating liquids and for condensing vapours.—J. Cocker. Improvements in self-acting mules for spinning and doubling.—W. E. Potter. Improved fastening for holding the cords of window blinds.—H. Skoines. Combined apparatus for manufacturing gas for lighting, heating, and cooking.—F. T. Krauth. Escapements for watches and other time-keepers. — B. Hewitt and S. Goff. Apparatus for raising and lowering weights or heavy bodies.—J. H. Johnson. Steam generators (com. by L. M. T. Riot and P. Roux.—A. M. Clark. Combined apparatus for sawing mitres and bevels, obtaining levels and determining angles (com. by J. H. Carpenter).—J. G. Tongue. Musical instruments named the "pyrohone" (com. by G. E. F. Koester.

On March 25th.—1092 to 1107.—J. G. Lawrie. Docking of ships, or the getting of them out of water for cleaning or repairs.—J. Kilner and S. C. Triston. Handles and scales of butchers' and dagger knives, and other similar articles.—The Baron T. de Mouncie. Machinery for cutting wood.—J. James and S. Burden. Machinery for gathering and tying wheat and other cereals in the field, and part of which may be applied to a reaping machine.—H. Hughes. Improved means of and appliances for marking, creasing, and cutting textile fabrics, for facilitating the sewing or the placing of devices thereon, such appliances being also applicable for marking, creasing, and cutting papers and metals.—S. Sampson. Rotary and multiplicate printing and numbering machine.—W. H. Wise. Furnaces for generating steam, or for other purposes.—T. Blundell, G. T. Blundell, and J. W. Blundell. Waterclosets of improved construction. (Complete Specification.)—J. McElroy. Slide valve gear of steam engines.—W. C. Fay. Machinery for treating fibrous plants or substances (com. by W. Shedd). (Complete specification.)—S. Lawson. Carriage axles and axle-boxes.—H. Holden. Carriage axles and axle-boxes.—F. Brampton. Fire grates or stoves for warming apartments.—E. C. Vickers. Preparation and treatment of paper to be used as a substitute for leather.—A. M. Clark. Manufacture and preservation of beer, and the treatment of yeast and wort, together with apparatus for the same (com. by L. Pasteur.)—J. H. Johnson. Devices for threading needles (com. by G. P. Farmer).

On March 26th.—1108 to 1131.—R. F. Fairlie. Trucks or bogies for railway (com. by G. Dixon)—T. A. Nield. Fuel economisers adapted to be employed in the heating of feed water for steam generators.—M. Vickers. Machinery or apparatus for producing motive power.—W. Morgan-Brown. Manufacture of hydraulic hose and machinery for that purpose (com. by E. P. Richardson.)—A. O. Sonntag. Platforms of railway stations for preventing accidents to passengers entering or alighting from railway carriages.—L. McDonald and M. Lenehan. Machine for harrowing, rolling, and sowing corn and seeds.—J. Goettler. Keyless watches (com. by O. Courvoisier.)—T. Maxted. Fuel and manufacture thereof.—J. E. Dowson. tramways (partly com. by A. Dowson.)—J. Bracewell and W. Pennett. Means or method employed for staining or producing on work or other surfaces imitations of inlaid wood, also for producing designs of any other character or colour on such surfaces.—W. E. Gedge. Apparatus or 'twister-whisk' for drawing, spinning, reeling, rolling up, turning or twisting, and doubling all textiles generally, and particularly for drawing and throwing every description and kind of silk (com. by L. Rocheblave, sen.)—F. A. Woodcock. Preparation of india-rubber. — G. H. Dana. Manufacture of flour for separating the bran and other dark-coloured portions from the white or farinaceous portions of sharps or middlings (com. by G. T. Smith).—C. Roberts, F.R.C.S. Preparation of powders for the destruction of animal and vegetable parasites, applicable also as disinfectants and deodorisers.—M. Williams. Apparatus for burning liquid fuel.—E. T. Moody. Manufacture of illuminating gas.—J. J. Harvey. Apparatus for washing bottles.—J. Shuttleworth. Steam boilers and furnaces.—J. Hamilton. Sewing machines.—B. Harlow. Wringing, mangling, and washing machinery, part of which is applicable to other purposes.—R. Fielden, jun., and T. Fielden. Construction of pickers.—H. B. Barlow. Pneumatic pumps (com. by N. J. Galland).—H. B. Barlow. Process for cleansing or purifying casks (com. by N. J. Galland).—M. I. Landau. Miners' safety lamps and other lamps, and apparatus for lighting, also furnaces, fire-places, and stoves or apparatus for heating, and instruments for kindling lights, parts of the improvements being applicable for ventilating.

On March 27th.—1132 to 1154.—R. Sedgewick and H. H. Lake. Apparatus for preventing fraud by the conductors or other persons in charge of omnibuses and other public conveyances.—W. Stratford. Furnace grates.—S. Edwards. Lawnmowers or machines for cutting grass.—F. Wirth. Steel rails (com. by F. Asthoewer).—J. Owen. Apparatus to be used for the purpose of passing the thread of the weft through the eye of the shuttle in shuttles to be used in manufacturing.—J. L. Nancarrow. Roofing and tiles for the same. —G. R. Hay. Manufacture of wheaten flour. —T. McDonald. Wrappers or envelopes for seed crushing.—R. Lister. Improved screw propeller for ships or vessels and improved machinery or apparatus for making the same. —S. Alley. Wheels.—C. Thackeray. Means for securing metal nuts on bolts.—W. E. Gedge. Improved photographic monocular with multiplicity of views, termed the magic circle (com. by A. C. Dallemagne and L. Triboult.—H. Cockney and F. C. Cockney. Grates or stoves for the heating of air and economising the consumption of fuel.—E. Shaw and G. Hunter. Boilers.—W. R. McKnig and J. C. Stitt. Floating baths.—E. Heywolth and N. Wilkinson. Steam boilers.—H. A. Bonneville. Presses for cotton and other articles. (com. by B. G. Martin). (Complete specification.) —G. W. Rendel. Hydraulic machinery for working ordnance.—J. H. Johnson. Treatment of certain vegetable fibrous substances and the application of the same to the manufacture of spun or twisted threads or cords, and also to the manufacture of paper and cardboard (com. by J. T. Vignolo).—J. H. Johnson. Drawing rollers of spinning mules (com. by M. Passieux).—E. N. Lacroix. Machines for separating and purifying middlings.—A. V. Newton. Mode of and apparatus for manufacturing railroad and other picks, adzes, shovels, hoes, and similar tools (com. by H. L. Lowman). G. H. Babcock and S. Wilcox. Steam boilers. (Complete specification.)

On March 28th.—1155 to 1167.—C. Sellers and W. H. Richardson. Improvement in stoves.—T. W. Kennard. Aquaria and apparatus connected therewith.—H. J. Hadden. Manufacture and use of fasteners suitable for straps, bands, and such like (com. by J. Fairman).—J. H. West. Machinery or apparatus for refrigerating or producing cold for the manufacture of ice and other purposes.—H. S. K. Bellairs. Turning over the leaves of music.—A. Davies. Dampers for furnaces.—W. J. Barber. Boot and shoe toe-pieces or tips.—J. Liebert. Treatment and application of substances not hitherto used as a substitute for chicory, for admixture with coffee, and other purposes for which chicory is used.—J. Morrison. Machinery for propelling steam launches and other twin-screw vessels.—J. Bullows and A. Bullows. Apparatus for clipping horses and other animals.—J. Williams. Apparatus for feeding sheep and other animals.—J. Harrop. Machinery or apparatus for the manufacture of what is commonly called india-rubber hose and india-rubber piping, and other tubular articles composed of similar materials.—J. Havenhand. Machine for cutting the teeth in sickles or reaping hooks, applicable also for cutting the teeth in reaping machine knives.

On March 29th.—1168 to 1178.—J. Darlington. Valves, method of working valves, and in feed motions for rock-boring engines, the improvement in valves, and method of working valves being partly applicable to other purposes.—M. J. Roberts. Foundations for bodies subjected to blows or pressure, especially applicable to anvils.—D. Bickford. Manufacture of pyroxyline to be employed as an explosive material, and in the manufacture of collodion, also in the treatment thereof when it is to be employed in the solid state for dental and other purposes (com. partly by Doctor Spooner, and the Pyroxyline Manufacturing Company).—C. N. Eyland. Buckles and fastenings of a similar nature.—A. V. Newton. Apparatus for ascertaining the rise and fall of temperatures, also for indicating the presence, and arresting the spread of fires (com. by Professor C. G. Grecchi.—H. P. Thorp. Manufacture of artificial fuel. J. Kennett. Improved dress.—B. Clarke. Wood-working machines, called trying-up and surfacing machines.—T. C. Newton and G. Dawson. Kitchen ranges.—G. Kemp. Artificial fuel.—H. Highton, M.A. Electric telegraphs, part of which are applicable to induction coils.

On March 31st.—1179 to 1193.—G. F. L. Meakin. Hanging sashes and shutters.—J. H. Johnson. Magnets (com. by H. Fontaine).—J. Goldsbrough. Apparatus for economising fuel in house fire-grates.—W. Taylor and H. L. Wilson. Wringing and mangling machines.—I. M. Singer. Improved cinder and ash receptacle for domestic and other fireplaces.—E. Holden. Treatment of wool and other fibres in the process of preparing.—T. Redmayne. Fire-grates.—A. M. Job. Knife cleaning boards, and parts to be employed in connection therewith.—H. Cochrane. Table knives and forks. (Complete specification).—W. Spence. Electric telegraphs (com. by F. F. Girarbon.—H. Marshall. Buckles or fasteners for straps.—A. Browne. Photography (com. by P. A. Despaquis).—G. H. Forbes. Balls, bricks, or blocks to be used as fuel.—H. J. Steel and R. W. Garland. Construction of domestic stove for economising the consumption of fuel and utilising the heat thereof.—A. M. Clark. Apparatus for the manufacture of gas for lighting and heating purposes (com. by A. Badt.)

THE FUTURE PRICE OF COAL.—It is from a general economy in consumption, and from scientific improvements in the manufacture of iron, that the greatest results are to be expected in diminishing the pressure upon the collieries, and consequently easing the market. But after all is done in these directions that can be reasonably expected the prices that have experienced such extraordinary inflation cannot, except for a temporary period during a general collapse or panic, suffer an equally extraordinary relapse. We have no hesitation in saying that to the average price of the ten years ending 1870 coal will never fall again.—*Iron.*

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APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur street, Charing Cross.

On April 1st,—1194 to 1207.—R. Smellie and J. Vance. Self-acting railway signal apparatus.—W. Beecroft. Construction of moulds for moulding metals, and the combination of materials for the same.—R. J. Gay. Manufacture of artificial fuels.—T. H. Sharpe. Apparatus for the moulding of clay and other plastic substances.—W. Morrison and J. Mitchell. Self-acting mules.—F. L. Rovedino. Manufacture of faggots of fire-lighters.—W. Anderson. System of checking tramway-car and other fares and payments.—Hon. R. Flower. New or improved fuel.—F. Johnston and R. T. Cotton. Looms for weaving.—W. Mitchell. Utilising the waste heat of smiths' fires for the purpose of economising fuel.—Rev. G. H. Forbes. Manufacture of cement, plaster, artificial stone, and other similar materials, also applicable for use as fuel.—A. M. Clark. Apparatus for raising and measuring acids and other liquids (com. by F. Nichols).—N. D. Spartall. Fuel.—H. Hill. Grates and fire-places.

On April 2nd.—1208 to 1227.—J. F. E. Chamas, L. Bouju, and M. R. Bouju. New textile obtained from the plant known as the "hibiscus esculentum," or "gombo."—W. Murdoch. Regulating the speed of motive-power engines worked by steam or other fluid.—J. Caldbeck. Preventing fraudulent appropriation of money by party or parties entrusted with the taking of fares of passengers on tramway cars or other conveyances.—B. Tydeman. Fitting and hanging of window sashes and making frames for sashes.—J. Young. Feeding steam boiler furnaces with fuel.—W. Palliser. Boots and shoes.—W. H. Gold. Reservoir penholder.—R. Sim, M.D., and A. Morgan. Varnish.—D. K. Clark, C.E. Machinery and apparatus for the manufacture of peat fuel and peat charcoal.—J. Watson. Apparatus for heating conservatories, greenhouses, and other horticultural structures.—W. M. Brown. Machines for cutting files (com. by A. Weed).—T. Silver. Air-rarefying lamp burner.—J. Newall. Producing motive force.—J. H. Johnson. Manufacture of cast steel and other metals, and in the making of castings of the same (com. by J. A. Holmes).—J. H. Johnson. Preparation of ozone, and in the application of the same to various useful purposes (com. by P. J. David, and J. Fichet).—W. R. Lake. Life-preserving mattress (com. by M. B. Mountain).—H. Smith. Apparatus for ventilating mill-stones, and machinery for separating the fine meal from the currents of air passing form mill-stones.—H. Holland. Manufacture of runners and top notches for umbrellas and parasols.—A. M. Clark. Falling carriage heads (com. by S. Berry).—A. M. Clark. Machinery for cleaning and separating ores (com. by J. H. Hillman).

On April 3rd.—1228 to 1246.—W. Clark. Apparatus for clipping or shearing horses and other animals.—L. M. R. Péan. Spinning tops, producing various sounds whilst in motion.—J. W. Grover. Washers for screw bolts.—H. Simon, C.E. Wire tramways (com. by C. Memlohs).—A. J. Maher. Appliances for hooking or securing, and for unhooking or unloosing horses from tramway or other cars or carriages while the same are in motion.—W. M. Brown. Improved granulating machine (com. by C. H. Horsey, F. C. Horsey, and R. B. Gray.—(Complete specification).—J. H. Johnson. Steam engines (com. by W. G. Ulery.—(Complete specification.)—T. E. Wilson. Machinery for screening and washing sand, coal, and other materials.—J. Maybery. Preparing iron for the manufacture of tin-plates or black-plates.—J. Howard and E. T. Bousfield. Steam boilers.—A. V. Newton. Improved shuttle motion for looms (com. by C. I. Kane).—G. W. Grawshaw. Open fire-places.—J. M. Cory. New or improved instrument for drawing in perspective.—A. M. Clark. Steam and hydraulic presses (com. by J. F. Taylor).—J. Pullman, junior, and J. R. Edmonds. Staking and grounding leather.—J. Blick. Railway breaks.—A. Thomas. Means of and appliances for relieving gas retorts from pressure, and for hermetically sealing the joints of hydraulic and other mains of gas works.—J. C. A. H. Wolfram. Preparing peat for use as fuel.—W. M. Brown. Machines for verifying the relative positions of the rails of a railway or a tramway (com. by Camozzi and Schlosser).

On April 4th.—1247 to 1266.—J. W. Hurst. Life rafts.—H. B. James, C.E. Seats of row boats.—J. S. Crosland. Steam boilers or generators.—G. Haseltine. Elevating apparatus (com). (Complete specification).—J. R. Harper. Gas-lamp blow-pipe apparatus, part of such improvements being applicable to other oil and spirit lamps.—W. L. Wise. Rotary pumps (com).—W. Tasker. Elevators or machines for elevating hay, corn, straw, and other agricultural produce.—C. N. Artsayoolof. Apparatus for effecting the releasing of ships' boats or other weights (com).—J. West. Improved method of manufacturing gas and for the apparatus employed therewith.—T. G. Woodley. Joints for joining metallic pipes and tubes.—W. M. Adams, B.A. Instrument for exhibiting the motion and position of the heavenly bodies relatively to any point on the surface of the earth, and for embodying the various conceptions necessary for nautical astronomy.—A. Jobson. Mode of utilising the waste heat of coke ovens, and in the construction of them.—W. Dawes. Fasteners for sashes or casements and other similar purposes.—J. W. Melling. Safety and relief valves.—R. Stone. Composition to be used for making, laying, or surfacing roadways, footways, and other similar surfaces, rendering them safe and slipless.—W.

Wood. Machinery or apparatus for finishing thread.—G. Pasley. Valves.—W. Black. Apparatus for clearing rails of railways and tramways.—S. Bonner. Kilns for burning bricks, tiles, drain pipes, lime, earthenware, and other analogous articles.—F. B. Taylor. Sewing machines.

On April 6th.—1267 to 1273.—S. Davey and J. Watson, C E. Apparatus and instruments for firing blasting charges.—W. M. Scott. Breech-loading small arms.—C. Willis. Fuel economisers, or apparatus for heating the feed water of steam generators, or superheating steam.—L. Weber. Galvanic batteries. (Complete specification).—H. Hobson. Method of, and apparatus for, ascertaining the temperature of hot blast or of heated gases, partly applicable to pyrometers otherwise used.—S. Mendel. Woven fabrics.—J. B. Walker. A new or improved fuel.

On April 7th.—1274 to 1283.—A. W. Ellis. Treatment of substances and liquors containing ammonia and cyanogen, and obtaining products therefrom.—A. Andrews. Elevators for stacking hay, corn, and other agricultural produce.—J. G. Hey and R. Sugden. Means or apparatus for treating and utilising gas tar for heating purposes.—T. Fearn. Electro-deposition of tin.—J. Henderson. Construction of steam ships and other ships or vessels.—G. Bear. Manufacture of cigars, and apparatus to be used for this purpose.—E. Edwards. Apparatus for drilling holes in rocks and other hard substances.—G. Leach. Construction and arrangement of winding gear, or apparatus for hauling, lifting, and winding.—W. Barton. Fire-places.—W. R. Lake. Sewing machines (com).

On April 8th.—1284 to 1302.—H. H. Bonnett. Seats and driving boxes of carriages and other vehicles.—A. W. Ellis. Utilization of waste products of ammoniacal liquor.—C. Brakell Improvements in the drying of peat and its manufacture or preparation into peat fuel, and the application of the said fuel to the manufacture of iron from the ore, some parts of the said improvements being also applicable for drying other materials or substances, and apparatus connected therewith.—T. F. Rowland. Apparatus for supplying and measuring coal, and charging and emptying gas retorts. (Complete specification).—T. Whitwell. Fire-places and stoves. (Complete specification).—J. E. Wilson, C.E. Propelling vessels. J. E. Wilson, C.E. Machinery for cutting wood.—C. E. Morris. Carriages with front bowed or other shaped front lights.—G. Gibbons and E. Paget. Means of, and apparatus for, collecting and removing hay and other out field crops.—J. H. Johnson. Metallic heels for boots and shoes, and the mode of attaching the same (com).—W. Bates. Securing the lids or covers of teapots, jugs, and other like vessels. W. Carron. Fastenings for brooches, sleeve links, and other articles of jewellery, ornament, and dress.—A. Keen. Machinery for the manufacture of screws.—F. E. Duckham and G. R. Birt. Grain and other elevators.—W. Shaw. Mechanical construction of printing types, and the tools employed for correcting typical errors. (Complete specification).—W. E. Gedge. Process of removing grease in the manufacture of tin-plates or terne-plates, and improved apparatus in connection therewith (com).—W. E. Gedge. Manufacture of parasols and umbrellas (com.)—T. C. Brown and G. A. Biddell. Steam-engines and boilers.—H. Larkin and W. White. Production of iron and steel.

On April 9th.—1303 to 1319.—G. M. Hammer. Construction of school furniture.—A. M. Silber. Improved burner.—A. S. Piatt. Means of ventilation, more particularly adapted to ships' holds, and the apparatus employed therefor.—G. Arnall. Construction of timber rods for pumping engines for mines and other works, also applicable for shears, girders, ships' keels, or for other similar purposes.—W. Green. Automatic couplings for railway and other carriages, also the formation of spikes for permanent way.—J. H. Johnson. Mode of, and apparatus for, removing sand banks at the mouths of harbours and other places (com).—W. D. Mann. Construction of railway carriages and fittings.—T. J. Smith.—Steam boilers, and the construction of fire-boxes and water-tubes for these and other steam boilers (com).—F. B. Houghton. Special process or method of operating upon straw, esparto, flax, and other similar fibrous materials for the manufacture of pulp for paper.—J. Brough. Apparatus for saving life and property at sea, which improvements are also applicable to the landing of mails and passengers.—L. Godda. Certain new and useful improvements in that class of naval vessels termed Monitors. (Complete specification).—G. Twigg. Shearing and clipping apparatus.—J. Davey. Steam generators.—J. Chisholm. Machines for doubling known as "twiners."—C. H. Sieber. Mode of, and apparatus for, removing the incrustation from steam boilers.—A. R. Ecroyd and J. Wars. Furnaces for steam-boilers and other purposes.—G. Alsing, C.E. Treatment of night soil, of sewage deposits, and other similar moist manurial matters.

STEAM LOCOMOTION ON COMMON ROADS.

By John Head, Soc. Inst. C E.

(Continued from our Last.)

LOCOMOTIVES FOR USE IN AGRICULTURAL OPERATIONS, STEAM PLOUGHING, &c.

Although several excellent farm locomotives were in use, there was not much novelty in the construction of these engines, and they really consisted of a portable engine, fitted with various methods of transmitting the power from the crank shaft to the road wheels.

The chief difficulty which had beset engineers in the construction of this class of machinery, had been the impossibility of theoretically calculating the varied strains to which the component parts of such an engine were subjected, in the same manner as in a railway locomotive, and the principal proportions of the engines illustrated in the paper had been the result of a long and careful experience and laborious experiment.

The two first self-moving or traction engines were exhibited by Messrs. Ransome; the first in 1846, at the Royal Agricultural Society's Meeting, at Bristol, and the second in 1849, at Norwich; but as the idea of moving the engines by steam did not find favour with farmers, little was done until eight or nine years after, when Mr. Burrell designed his agricultural locomotive, in which the transmission between the engine and driving wheels was effected by means of a pitched chain, and with several improvements he had adhered to this principle to the present time. One feature in his engine was worthy of notice. The hinder part of the engine was mounted upon volute springs, set at an angle, so as not to interfere with the movement of the chains, and it has been found in practice that, the use of springs diminished to a great extent the wear and tear of the engine.

Mr. Aveling exhibited his first engine at the Royal Agricultural Society's Meeting at Canterbury, in 1860. It also worked with a pitched chain, and was steered by means of a fifth wheel, in the form of a disc, placed at the end of a wrought frame, fixed to the fore axle. The boiler was of the usual locomotive type, with one cylinder placed on the top, and the crank shaft was connected with the driving wheels by means of malleable iron gearing. An ingenious arrangement for facilitating the turning of corners, called a "compensating gear" or "Jack in the box," was fixed on the driving axle, thus avoiding the necessity of clutches for throwing the driving wheels in and out of gear when going round sharp corners.

Messrs. Clayton and Shuttleworth, and Messrs. John Fowler and Co., also manufactured agricultural engines, equal in point of workmanship and design to those already described, but differing somewhat in their general arrangement and details.

STEAM PLOUGHING ENGINES.

Messrs. Fowler's steam ploughing engines being constructed so as to move themselves on the road, and haul not only the implements which form part of the tackle, but also waggons, from one part of the farm to another, came within the range of locomotives on common roads.

The "double-engine system" of steam ploughing, in which each engine was placed on an opposite headland of the field, moving themselves at intervals, and alternately winding up or paying out the steel rope which hauled the implements to and fro, had been found the most economical in the variety of trials to which steam ploughs had been subjected for several years, and the author had selected the 12 h.p. engine of Messrs. Jno. Fowler and Co., of Leeds, as the most perfect specimen of a steam-ploughing engine yet designed.

The engines for steam ploughing were generally of more power, and, consequently, heavier than the ordinary farm engine, on account of the greater amount of power which was necessary to till the land, than to perform any other agricultural operation.

The following data respecting the cost of power in steam ploughing were deduced by the judges at Wolverhampton, in 1871, from the various experiments and trials carried out at that time:—

The average consumption of—

Coal = 161 lbs. per acre.

Water = 115 gals. per acre.

Oil and tallow = 5·1 ozs. per acre.

Water per lb of coal = 7·2 lbs.

Coal, per mean indicated h.p. per hour 7·1 lbs.

The average weight of earth moved per lb. of coal = 9·3 tons.

ROAD LOCOMOTIVES FOR MILITARY PURPOSES.

So little experience has been gained in the employment of road locomotives for the purpose of hauling heavy guns, siege trains, and transport waggons in time of actual war, that no reliable data existed upon which to form a practical opinion respecting the advantages of their use in lieu of horses for the transport of war material. It had, however, for some time been the opinion of some of our most experienced engineer and artillery officers, that steam power might be advantageously employed as an important auxiliary to an army on the march.

A road locomotive could be used as a fixed engine, to saw wood or pump water. It could be employed for transporting guns or other war material, and was specially useful in the neighbourhood of a fortress, when the town formed the apex of the triangle, and the railway the two sides, which, however, could not be used by the besieging army. All stores and provisions required to be transported beyond the fortress must go along a line of road forming the base of this triangle, and the traction engine, with its train, would form a much more rapid means of communication between the two railway stations, than ordinary carts or waggons drawn by horses or bullocks. The Prussians, at Metz, constructed a line 20 kilometres long, to skirt the fortress of the city, but it was not required, as the garrison capitulated before its completion.

In addition to the above uses, the engine could be so constructed that flanged railway wheels might be substituted for the ordinary rigid wheels used on common roads, and it would then serve as a light railway locomotive in case the enemy destroyed or secured all the rolling stock on the existing railways.

A traction-engine for military purposes should be made as light as possible, and constructed, almost entirely, of wrought iron or steel, in order to diminish the chances of breakage. Its weight should not exceed 5 tons, with about 72 cwt. on the driving wheels in order that it might be able to pass over the pontoons as at present constructed, and also over temporary wooden bridges, hastily made to repair the arches in masonry or iron, blown up by the enemy. It should be furnished with a powerful windlass, arranged in such a manner that the engine, after having ascended a hill or traversed a soft road or marsh, could remain stationary, and haul the guns or waggons up the incline or through the bog by means of a steel rope, one end of which would be fastened to the load and the other to the drum, which would be slowly wound up by the engine, thus enabling it to drag heavy loads through difficult places almost inaccessible for horses.

Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE.

JUNE 1, 1873.

IN MEMORIAM.

AGAIN we appear before the public bearing the symbols of mourning and death. Again we have to deplore a great loss. The hand of death has been uplifted, and this time to strike the fatal blow at one of the staunchest of the friends of the inventors' cause. ROBERT MARSDEN LATHAM, the Secretary of the Inventors' Institute, and one of the founders of it, is amongst us no more—he has passed away to the spirit world—and the only salutation we can now give him is, *Requiescat in Pace.*

We are at a loss to find words to express the deep sense of deprivation we suffer; for the deceased was no ordinary man, and possessed a fertility of thought, and an amount of practical resource, that rendered him a worker whose labours were well-directed and indefatigable. It is true that as a man of science we cannot rank him with our late lamented President, Sir David Brewster, or with Professor McGauley, both of whom pre-deceased him, but as a worker on behalf of the just rights and claims of inventors, he was *nulli secundus.*

It is now a good many years ago since our deceased friend began to direct his thoughts to the position and prospects of the legal and social *status* of the inventors in the United Kingdom, and, taking counsel with such men as Mr. Richardson, Mr. Hume Williams, Mr. Thomas Webster, Captain J. H. Selwyn, R.N., Mr. F. W. Campin, Mr. C. G. Carttar, and others, was led, over ten years ago, to gather together an array of inventive genius whose names are on the roll of its council, and inaugurate the Inventors' Institute, which has now become one of the foremost of our scientific and social institutions.

Mr. Latham's perspicacity led him to see that the inventor's power would be comparatively small, unless supported by the power of the Press, and although striving, and with success, to maintain friendly relations with all public journals, he nevertheless determined that inventors should possess an organ of their own, and as with him the work of the brain and the action of the hand followed so quickly one upon the other as to be almost simultaneous, so the establishment of the SCIENTIFIC REVIEW might be said to be the simple and natural expression of a thought placed before the world in a practical and tangible form. To secure the success of this journal he spared no expense or trouble, seeking for writers amongst men of scientific eminence, whom he assisted with the practical aid of his own intimate knowledge of the wants and wishes of inventors and men of science. The fame of this journal soon became world-wide, for under his guidance it attained the character not merely of a scientific journal, but virtually that of an inventor's intelligencer.

The political aspect of the inventors' question received much attention from Mr. LATHAM, for having been brought into communication with Mr. Thomas Paterson and Mr. George Savage, leading men in the last movement for working-men's exhibitions,—that held in the Agricultural Hall, in the year 1870, he strenuously exerted himself to bring about a co-operation of the working classes with inventors, which led to his obtaining a position in working-men's movements generally that has been regarded by some persons with little favour, but on certain occasions has been found to be very efficacious in obtaining from our Government proper consideration for the question of the interests of inventors as affected by the patent laws.

Technical education, also, was a subject which engaged much of the attention of our deceased friend, and, in conjunction with Mr. F. W. Campin, he did much to advance this important question of the day, which has now become, one may almost say, a fashionable topic.

The movement on behalf of Tribunals of Commerce met with much sympathy and support from Mr. LATHAM, not only as a friend of law reform in general, but also from the consideration that such Tribunals might be advantageously applied to the determination of patent, trade mark, and copyright questions.

In the operations of the Inventors' Institute generally, Mr. LATHAM may be fairly said to have been the central figure, for he was ever ready to counsel and to write in its behalf, and, in fact, he directed, on his death-bed, certain communications to be made with reference to the Patent Laws, to Mr. Hinde Palmer, Q.C., M.P., Mr. J. Howard, M.P., and Mr. Mundella, M.P. But the public career of the deceased was not the only estimable part of his life, for those who enjoyed his private friendship well know that he was a genial companion, ever kindly disposed towards all his associates, in whose memories he will still continue to live.

MR. LATHAM, who was 38 years of age at the time of his decease, has left a widow and son who have to mourn the loss of an estimable husband and loving father. He was born in Lancashire, and died at his house at Hampstead, on April 29th, having been ill little more than one week. His mortal remains were deposited in the parish cemetery of St. John's, Hampstead, the funeral being attended not only by relatives and personal friends, but by some members of the Council of the Inventors' Institute, and a number of his associates in public life.

Though our loss cannot be easily repaired, yet we need not despair if all the members of the Institute join in heartily forwarding its welfare. Let them consider that "though dead, he speaketh" to them in words of exhortation and entreaty, adjuring them to continue with vigour the great work thus the so well begun, carried on, and caused to flourish, and make it to stand firm as a goodly memento of his organising genius and persistent labour.

Reviews.

Principles of Animal Mechanics. By the Rev. Samuel Haughton, F.R.S., Fellow of Trinity College, Dublin, M.D. Dubl. D.C.L., Oxon. *London*: Longmans, Green, and Co. 1873.

This is a work of profound scientific research, the nature and object of which cannot be better described than as observations and calculations which the author states have occupied his leisure hours during the past ten years; and are now offered to the public, with the view of showing the mutual advantages obtainable by anatomists and geometers from a combination of the sciences which they cultivate. Anatomists will gain by the increased precision which numerical statements must give to their observations, and geometers will find in anatomy a new field of problems opened out to their investigation; and, he adds, I may be allowed to call attention, from this point of view, to the problem of the equilibrium of an elliptical muscular dome, and to the use which I have made of the hyperboloid of one sheet, of Ptolemy's Theorem, and of some curves of the third order. In the course of my investigations, I have met with numerous instances, in the muscular mechanism of the vertebrate animals, of the application of the principle of least action in nature, by which I mean that the work to be done is effected by means of the existing arrangement of the muscles, bones, and joints, with a less expenditure of force than would be possible under any other arrangement; so that any alteration would be a positive disadvantage to the animal. If, as I consider probable, this fact should prove to be of much wider occurrence in nature than those instances show, it may serve to give us some slight glimpse of the mechanism by which the conservation of species in nature is secured. In astronomy, the conservation of the solar system depends upon certain well-known conditions regulating the motions of the several bodies of which that system consists, and it is a matter of indifference whether these conditions were directly imposed by the will of the Divine contriver, or were the indirect result of some former condition of the system. In either case, those conditions are equally the foreseen result of the contrivance. If the present state of the solar system be the result, according to fixed laws, of some preexisting state of that system, it may be said, in the language of naturalists, to have been evolved out of its former state, but in such an evolution there was nothing left to chance; it was all foreseen, and the evolution itself presided over by the Divine mind that planned the whole. I cannot see why there may not be in organic life a similar process of evolution of higher from lower forms of existence, but it is a teleological evolution, in which every step and every result was foreseen and planned beforehand. The laws of such an evolution appear to me in the present state of our knowledge, to be entirely unknown.

I have explained the similarity of muscles and bones in the vertebrate animals on simple teleological principles, without making use of the improved hypothesis of their descent from a supposed common ancestor.

In the discussion of the theory of muscular types, and of the laws of fatigue and refreshment, I have succeeded in obtaining many new and interesting applications of exact science to the problems of animal mechanics.

I take this opportunity of returning my thanks to Dr. Alexander Macalister and to the Rev. Richard Townshend, who have assisted me materially in the anatomical and geometrical branches of my subject; and also, to the Provost and Senior Fellows of Trinity College, Dublin, for the assistance they have given me, by defraying a portion of the expenses of publication.

Popular Lectures on Scientific Subjects. By H. Helmholtz, Professor of Physics in the University of Berlin. Translated by E. Atkinson, Ph.D., F.C.S., Professor of Experimental Science, Staff College. With an introduction by Professor Tyndall. London Longmans, Green, and Co. 1873.

This is a work of the highest merit, eminently adapted for the present times, upholding the education in practical mathematics and experimental science as the true course of instruction for our youths rather than classical and philological studies, supplemented, may be, by some small doses of ordinary scholastic mathematics, forgotten, perhaps, as soon as learned.

Most clearly are these views brought out and illustrated in the lectures before us, as the following passage taken from the lecture in the relation of natural science to general science emphatically affirms

I do not intend (says the author) to go deeply into the question how far mathematical studies, as the representatives of conscious logical reasoning, should take a more important place in school education. But it is, in reality, one of the questions of the day. In proportion as the range of science extends, its system and organisation must be improved, and it must inevitably come about that individual students will find themselves compelled to go through a stricter course of training than grammar is in a position to supply. What strikes me in my own experience of students who pass from our classical schools to scientific and medical studies, is first, a certain laxity in the application of strictly universal laws. The grammatical rules, in which they have been exercised are for the most part followed by long lists of exceptions, accordingly they are not in the habit of relying implicitly on the certainty of a legitimate deduction from a strictly universal law. Secondly, I find them for the most part too much inclined to trust to authority, even in cases where they might form an independent judgment. In fact, in philological studies, inasmuch as it is seldom possible to take in the whole of the premisses at a glance, and inasmuch as the decision of disputed questions often depends on an æsthetic feeling for beauty of expression, and for the genius of the language attainable only by long training, it must often happen that the student is referred to authorities even by the best teachers. Both faults are traceable to a certain indolence and vagueness of thought, the sad effects of which are not confined to subsequent scientific studies. But certainly the best remedy for both is to be found in mathematics, where there is absolute certainty in the reasoning, and no authority is recognized but that of one's own intelligence.

The practical utility of those studies is urged upon us in the following truthful and apposite statements:—

Knowledge is not the sole object of man upon earth. Though the sciences arouse and educate the subtlest powers of the mind, yet a man who should study simply for the sake of knowing, would assuredly not fulfil the purpose of his existence. We often see men of considerable endowments, to whom their good or bad fortune has secured a comfortable livelihood or good social position, without giving them, at the same time, ambition or energy enough to make them work, dragging out a weary, unsatisfied existence, while all the time they fancy they are following the noblest aim of life by constantly devoting themselves to the increase of their knowledge, and the cultivation of their minds. Action alone gives a man a life worth living; and therefore he must aim either at the practical application of his knowledge, or at the extension of the limits of science itself. For to extend the limits of science is really to work for the progress of humanity. Thus we pass to the second link, uniting the different sciences, the connection, namely, between the subjects of which they treat.

Knowledge is power. Our age, more than any other, is in a position to demonstrate the truth of this maxim. We have taught the forces of inanimate nature to minister to the wants of human life and the designs of the human intellect. The application of steam has multiplied our physical strength a million-fold, weaving and spinning machines have relieved us of labours, the only merit of which consisted in a deadening monotony. The intercourse between men, with its far reaching influence on material and intellectual progress, has increased to an extent of which no one could have even dreamed within the lifetime of the older among us. But it is not merely on the machines by which our powers are multiplied; not merely on rifled cannon, and armour-plated ships, not merely on accumulated stores of money and the necessaries of life, that the power of a nation rests; though these things have exercised so unmistakeable an influence, that even the proudest and most obstinate despotisms of our times have been forced to think of removing restrictions on industry, and of conceding to the industrious middle classes a due voice in their counsels. But political organization, the administration of justice, and the moral discipline of individual citizens are no less important conditions of the preponderance of civilized nations and so surely as a nation remains inaccessible to the influences of civilization in these respects, so surely is it on the high road to destruction. The several conditions of national prosperity act and react on each other; where the administration of justice is uncertain, where the interests of the majority cannot be asserted by legitimate means, the development of the national resources, and of the power depending upon them, is impossible; nor again, is it possible to make good soldiers except out of men who have learnt under just laws to educate the sense of honour that characterises an independent man, certainly not out of those who have lived the submissive slaves of a capricious tyrant.

From the general view of the subject we are conducted to the consideration of the physiological causes of harmony in music to ice and glaciers. The world of ice and of eternal snow, as unfolded to us on the summits of the neighbouring Alpine chain, so stern, so solitary, so dangerous, it may be, has yet its own peculiar charm. Not only does it enchain the attention of the natural philosopher, who finds in it the most wonderful disclosures as to the present and past history of the globe, but every summer it entices thousands of travellers of all conditions, who find there mental and bodily recreation. While some content themselves with admiring from afar the dazzling adornment which the pure luminous masses of snowy peaks, interposed between the deeper blue of the sky and the succulent green of the meadows, lend to the landscape, others more boldly penetrate into the strange world, willingly subjecting themselves to the most extreme degrees of exertion and danger, if only they may fill themselves with the aspect of its sublimity.

I will not attempt what has so often been attempted in vain—to depict in words the beauty and magnificence of nature, whose aspect delights the Alpine traveller. I may well presume that it is known to most of you from your own observation; or, it is to be hoped, will be so. But I imagine that the delight and interest in the magnificence of those scenes will make you the more inclined to lend a willing ear to the remarkable results of modern investigations on the more prominent phenomena of the glacial world. There we see that minute peculiarities of ice, the mere mention of which might at other times be regarded as a scientific subtlety, are the causes of the most

important changes in glaciers: shapeless masses of rock begin to relate their histories to the attentive observer, histories which often stretch far beyond the past of the human race into the obscurity of the primeval world; a peaceful, uniform, and beneficent sway of enormous natural forces, where at first sight only desert wastes are seen, either extended indefinitely in cheerless, desolate solitudes, or full of wild, threatening confusion—an arena of destructive forces. And thus I think I may promise that the study of the connection of those phenomena of which I can now only give you a very short outline will not only afford you some prosaic instruction, but will make your pleasure in the magnificent scenes of the high mountains more vivid, your interest deeper, and your admiration more exalted.

Let me first of all recall to your remembrance the chief features of the external appearance of the snow-fields and of the glaciers; and let me mention the accurate measurements which have contributed to supplement observation, before I pass to discuss the casual connection of those processes.

The higher we ascend the mountains the colder it becomes. Our atmosphere is like a warm covering spread over the earth; it is well nigh entirely transparent for the luminous darting rays of the sun, and allows them to pass almost without appreciable change. But it is not equally penetrable by obscure heat-rays, which, proceeding from heated terrestrial bodies, struggle to diffuse themselves into space. These are absorbed by atmospheric air, especially when it is moist; the mass of air is itself heated thereby, and only radiates slowly into space the heat which has been gained. The expenditure of heat is thus retarded as compared with the supply, and a certain store of heat is retained along the whole surface of the earth. But on high mountains the protective coating of the atmosphere is far thinner—the radiated heat of the ground can escape thence more freely into space; there, accordingly, the accumulated store of heat and the temperature are far smaller than at lower levels.

To this must be added another property of air which acts in the same direction. In a mass of air which expands, part of its store of heat disappears; it becomes cooler, if it cannot acquire fresh heat from without. Conversely, by renewed compression of the air, the same quantity of heat is reproduced which had disappeared during expansion. Thus if, for instance, south winds drive the warm air of the Mediterranean towards the north, and compel it to ascend along the great mountain wall of the Alps, where the air, in consequence of the diminished pressure, expands by about half its volume, it thereby becomes very greatly cooled for a mean height of 11,000 feet, by from 18° to 30° C., according as it is moist or dry; and it thereby deposits the greater part of its moisture as rain or snow. If the same wind, passing over to the north side of the mountains as Föhn-wind, reaches the valleys and plains, it again becomes condensed, and is again heated. Thus the same current of air which is warm in the plains, both on this side of the chain and on the other, is bitterly cold on the heights, and can there deposit snow, while in the plain we find it insupportably hot.

The lower temperature at greater heights, which is due to both these causes, is, as we know, very marked on the lower mountain chains of our neighbourhood. In central Europe it amounts to about 1° C. for an ascent of 480 feet; in winter it is less—1° for about 720 feet of ascent. In the Alps the differences of temperature at great heights are accordingly far more considerable, so that upon the higher parts of their peaks and slopes the snow which has fallen in winter no longer melts in summer. This line, above which snow covers the ground throughout the entire year, is well known as the snow-line; on the northern side of the Alps it is about 8,000 feet high, on the southern side about 8,800 feet. Above the snow-line it may on sunny days be very warm; the unrestrained radiation of the sun, increased by the light reflected from the snow, often becomes utterly unbearable; so that the tourist of sedentary habits, apart from the dazzling of his eyes, which he must protect by dark spectacles or by a veil, usually gets severely sunburnt in the face and hands, the result of which is an inflammatory swelling of the skin and great blisters on the surface. More pleasant testimonies to the power of the sunshine are the vivid colours and the powerful odour of the small Alpine flowers which bloom in the sheltered rocky clefts among the snow-fields. Notwithstanding the powerful radiation of the sun the temperature of the air above the snow-fields only rises to 5°, or at most 8°; this, however, is sufficient to melt a tolerable amount of the superficial layers of snow. But the warm hours and days are too short to overpower the great masses of snow which have fallen during colder times. Hence the height of the snow line does not depend merely on the temperature of the mountain slope, but also essentially on the amount of the yearly snow-fall. It is lower for instance on the moist and warm south slope of the Himalayas, than on the far colder but also far drier north slope of the same mountain. Corresponding to the moist climate of western Europe, the snow-fall upon the Alps is very great, and hence the number and extent of their glaciers are comparatively considerable, so that few mountains of the earth can be compared with them in this respect. Such a development of the glacial world is, as far as we know, met with only on the Himalayas, favoured by the greater height, in Greenland and in Northern Norway, owing to the colder climate, in a few islands in Iceland, and in New Zealand, from the more abundant moisture.

Places above the snow-line are thus characterised by the fact that the snow which in the course of the year falls on its surface, does not quite melt away in summer, but remains to some extent. This snow, which one summer has left, is protected from the farther action of the sun's heat by the fresh quantities that fall upon it during the next autumn, winter, and spring. Of this new snow also next summer leaves some remains, and thus year by year fresh layers of snow are accumulated one above the other. In those places where such an accumulation of snow ends in a deep precipice, and its inner structure is thereby exposed, the regularly stratified yearly layers are easily recognized.

But it is clear that this accumulation of layer upon layer cannot go on indefinitely, for otherwise the height of the snow peak would continually increase year by year. But the more the snow is accumulated the steeper are the slopes, and the greater the weight which presses upon the lower and older layers and tries to displace them. Ultimately a state must be reached in which the snow slopes are too steep to allow fresh snow to rest upon them, and in which the burden which presses the lower layers downwards is so great that these can no longer retain their position on the sides of the mountain. Thus, part of the snow which had originally fallen on the higher regions of the mountain above the snow-line, and had there been protected from melting, is compelled to leave its original position and seek a new one, which it of course finds only below the snow-line on the lower slopes of the mountain, and especially in the valleys, where however being exposed to the influence of a warmer air, it ultimately melts and flows away as water. The descent of masses of snow from their original positions sometimes happens suddenly in avalanches, but it is usually very gradual in the form of glaciers.

Thus we must discriminate between two distinct parts of the ice-fields; that is, first, the snow which originally fell—called "firn" in Switzerland—above the snow-line, covering the slopes of the peaks as far as it can hang on to them, and filling up the upper wide kettle-shaped ends of the valleys forming widely extended fields of snow or "firnmeere." Secondly, the glaciers, called in the Tyrol "firner," which as prolongations of the snow-fields often extend to a distance of from 4,000 to 5,000 feet below the snow-line, and in which the loose snow of the snow-fields is again found changed into transparent solid ice. Hence the name glacier, which is derived from the Latin, *glacies*; French, *glace*, *glacier*.

The outward appearance of glaciers is very characteristically described by comparing them with Goethe to currents of ice. They generally stretch from the snow-fields along the depth of the valleys, filling them throughout their entire breadth, and often to a considerable height. They thus follow all the curvatures, windings, contractions, and enlargements of the valley. Two glaciers frequently meet, the valleys of which unite. The two glacial currents then join in one common principal current, filling up the valley common to them both. In some places these ice-currents present a tolerably level and coherent surface, but they are usually traversed by crevasses, and both over the surface and through the crevasses countless small and large water rills ripple, which carry off the water formed by the melting of the ice. United, and forming a stream, they burst, through a vaulted and clear blue gateway of ice, out at the lower end of the larger glacier.

The lecture continues the development of this subject to the fullest extent, concluding as follows:—

Thus to the eye of the natural philosopher the glacier, with its wildly-heaped ice-blocks, its desolate, stony, and muddy surface, and its threatening crevasses, has become a majestic stream whose peaceful and regular flow has no parallel, which, according to fixed and definite laws, narrows, expands, is heaped up or, broken and shattered, falls down precipitous heights. If we trace it beyond its termination we see its waters, uniting to a copious brook, burst through its icy gate and flow away. Such a brook on emerging from the glacier, seems dirty and turbid enough, for it carries away as powder the stone which the glacier has ground. We are disenchanted at seeing the wondrously beautiful and transparent ice converted into such muddy water. But the water of the glacier streams is as pure and beautiful as the ice, though its beauty is for the moment concealed and invisible. We must search for these waters after they have passed through a lake in which they have deposited this powdered stone. The Lakes of Geneva, of Thun, of Lucerne, of Constance, the Lago Maggiore, the Lake of Como, and the Lago di Garda are chiefly fed with glacier waters; their clearness and their wonderfully beautifully blue or blue-green colour are the delight of all travellers.

Yet, leaving aside the beauty of these waters, and considering only their utility, we shall have still more reason for admiration. The unsightly mud, which the glacier streams wash away, forms a highly fertile soil in the places where it is deposited; for its state of mechanical division is extremely fine, and it is moreover an utterly unexhausted virgin soil, rich in the mineral food of plants. The fruitful layers of fine loam which extend along the whole Rhine plain as far as Belgium, and are known as Loess, are nothing more than the dust of ancient glaciers.

Then, again, the irrigation of a district, which is effected by the snow-fields and glaciers of the mountains, is distinguished from that of other places by its comparatively greater abundancy, for the moist air which is driven over the cold mountain peaks de-

posits there most of the water it contains in the form of snow. *In the second place*, the snow melts most rapidly in summer, and thus the springs which flow from the snow-fields are most abundant in that season of the year in which they are most needed.

Thus we ultimately get to know the wild, dead ice-wastes from another point of view. From them trickles in thousands of rills, springs, and brooks the fructifying moisture which enables the industrious dwellers of the Alps to procure succulent vegetation and abundance of nourishment from the wild mountain slopes. On the comparatively small surface of the Alpine chain they produce the mighty streams, the Rhine, the Rhone, the Po, the Adige, the Inn, which for hundreds of miles form broad, rich river-valleys, extending through Europe to the German Ocean, the Mediterranean, the Adriatic, and the Black Sea. Let us call to mind how magnificently Goethe, in "Mahomet's Song," has depicted the course of the rocky spring, from its origin beyond the clouds to its union with Father Ocean. It would be presumptuous after him to give such a picture in other than his own words:—

> And along, in triumph rolling,
> Names he gives to regions, cities
> Grow amain beneath his feet.
>
> On and over on he rushes;
> Spire and turret fiery crested,
> Marble palaces, the creatures
> Of his wealth, he leaves behind.
>
> Pine-built houses bears the Atlas
> On his giant shoulders. O'er his
> Head a thousand pennons rustle,
> Floating far upon the breezes,
> Tokens of his majesty.
>
> And so beareth he his brothers,
> And his treasures, and his children,
> To the primal sire expectant,
> All his bosom throbbing, heaving
> With a wild tumultuous joy.

THEODORE MARTIN'S *Translation*.

The work also contains lectures on the Interaction of Natural Forces, the Recent Progress of the Theory of Vision, much of which we should like to transfer to our pages, but at present we must forbear.

Comets' Tails no Longer a Mystery, and a Few Questions. By J. A. R. London: Reeves, Son and Co., Playhouse-yard, Ludgate-hill, E.C.

THIS is a little book containing many illustrative woodcuts, and although we cannot endorse all the author advances, we think it well worthy of attentive perusal. Much of the author's views are given in the following passages:

When a comet is seen merely as nebula of an irregular form, that irregularity depends upon the vapours floating in the sphere capable of reflecting light, and as the whole revolves a constant change of form is a necessary consequence.

When a comet is seen in the distance, it receives so little light from the sun that the tail is often not seen, or seen very feebly, but as it approaches the sun, the tail increases in brilliancy and length, simply because that portion of the comet's atmosphere furthest from the sun, becomes better illuminated by the concentration of the light passing through the whole sphere, especially the central portion.

By adopting the theory that the nucleus consists of various aggregations and densities of gaseous matter, and that the whole revolves on an axis, there is no difficulty in accounting for all the changes which the tails assume; sometimes being single, at other times divided into two or more parts.

To strengthen the theory that the nucleus is partially made up of different aggregations of gas as before-mentioned, it is only necessary to refer to the descriptive forms ascribed to the nucleus by various astronomers. Of these they computed that the comet of 1860 when nearest the sun travelled upwards of a million miles per hour, and that it changed the direction of its tail 150 degrees in five days. What then must have been the speed of the extremity of the tail?

It has always been most perplexing to account for any power capable of operating upon the tails of comets so as to impel them through such an almost inconceivable space in so short a time.

If the theory I have already suggested be correct, that comets have atmospheres surrounding them to the fullest extent of the tails, then so fast as they advance in their orbits round the sun, so fast do different parts of their atmospheres become illuminated by the sun's rays passing through them, and the change of positions takes place simultaneously with the rapidity of light, their tails being necessarily projected from the side furthest from the sun and thus the whole difficulty, as to the rapid motions of the tails, is removed.

The appearance which sometimes occurs of an illuminated part projecting from the head towards the sun, may be accounted for by the nucleus reflecting back a portion of the light it receives from the sun, instead of allowing the whole to pass through. We know that if a round bottle of clear water is placed on a table, and a light at a distance is allowed to fall upon it, a large portion of the light passes through, and is concentrated beyond the bottle, but a portion is reflected back on the table towards the light—that which is reflected represents the head, and that which passes through represents the tail.

A horn or any other form of light seen between the nucleus and the sun is an evidence that the comet's atmosphere exists there, for we know that light is invisible until it fall upon some body capable of reflecting it.

By admitting that light is refracted through the nucleus, &c., colour of various hues is a natural consequence and needs no comment.

The pulsations of light which are generally seen passing from the nucleus through the tail, may be accounted for by this theory, inasmuch as the whole comet, including every portion of its atmosphere, is supposed to revolve on an axis, and is therefore in a constant state of change in the relative position of its parts. The outer portions of its atmosphere (like the earth's atmosphere) of course must have a slower motion than the more central, and as the light passing through the nucleus falls upon different portions or aggregations of the gaseous tail, as they are presented, so a flittering or pulsating effect is produced.

It is well known that the tails of comets are transparent, because stars can be seen through them; but the admission of their transparency has always created a difficulty, as transparent bodies are known to refract oblique rays of light, and cause objects seen through them to appear to alter their position, but with comets' tail no such effect has been observed for the stars (apparently) shine through the tails without refraction.

By way of illustrating the above, hold a piece of thick window glass in front of you, and look through it obliquely at an object in the distance; the object will appear in a different position from that in which it does without the interposition of the glass.

Now the question arises, if the tails are gaseous and transparent, why should not the light from the stars be affected in like manner?

Although this question has always been considered perplexing and never satisfactorily answered; by adopting the theory that the nuclei of comets are entirely surrounded by an atmosphere, as before explained, the problem becomes simple.

If the position of a star seen in close proximity to the tail of a comet be carefully observed, the fact of the illuminated part called the tail passing in front, can have no effect whatever, either to increase or diminish the refraction of the light coming from the star, for the star is seen through the same medium as the tail a long time before the illuminated tail interposes, and therefore under the same refraction. When the tail has passed the star, no change of position of the star takes place until the atmosphere has travelled forward to a considerable distance.

The above I think is the solution of the mystery.

Our Seamen. An Appeal. By SAMUEL PLIMSOLL, M.P. London: Virtue and Co., 26, Ivy-lane, Paternoster-row. 1873.

WHATEVER may be the issue of the law proceedings now pending between Mr. Plimsoll, and the gentlemen who consider themselves maligned by the statements he has made in his book, yet this general verdict must, and we doubt not will, be pronounced by the public in the measures he has taken to arouse national action on behalf of safety of life and property at sea; and it is that he deserves the hearty thanks of his countrymen for having stepped forward in a bold and uncompromising manner to deal with the monster evils arising from the use of badly constructed and rotting vessels, overloading, and other preventible causes of maritime disaster.

Notwithstanding what officials (who are always bitterly opposed to unofficial interference), shipowners, and others may say, it has long been known that the evils we have referred to have existed for many years past, and have been increasing rather than diminishing. The Poor Jack has been little regarded by the shipowning interest, indeed, if special legal regulations had not been made with regard to him, he would probably, before this, have been reduced to a position on a level with the Russian serf; even, as matters now stand, he is liable to constrained service in a "coffin ship," unless he accepts the alternative of being sent to a criminal prison—there to do "hard labour" in company with murderers and felons, for the provisions of the law in his favour, by which he may escape, are both so arranged as to be, practically, all moonshine. Like all laws affecting the employed, when made by the employing class, they are tolerably well fitted to serve the interests of the latter, whilst they are but ill fitted to protect the interests of the former.

The remedies for the evils referred to by Mr. Plimsoll involve scientific and practical questions, and must not be treated in an off-hand manner. In truth, we must confess that we consider that it will be very difficult to lay down a "hard and fast line" as to the proper construction of ships, load line, and the number of men required for the proper navigation of a ship; and we should prefer that some system of "surveying juries" of, say, five members of which practical seamen should form part, should determine these matters in the basis of certain broad general principles in each disputed case.

We refrain from quotations from this work the subject is so momentous, and the work so widely disseminated that we think our readers should peruse it and judge for themselves.

The Races of Mankind, being a popular description of the characteristics, manners and customs of the principal varieties of the Human Family. By ROBERT BROWN, M.A., Ph.D., F.L.S., F.R.G.S., President of the Royal Physical Society, Edinburgh. Illustrated. Cassell, Petter, and Galpin, London, Paris, and New York.

THIS is a useful and entertaining serial, which we commend to the favourable consideration of our readers.

General Literature.

Unorthodox London; or, the Phases of Religious Life in the Metropolis. By Rev. C. Maurice Davies, D.D. Tinsley Brothers.

This book is written in a very liberal spirit, and treats of a subject in which many people take a deep interest. Unorthodox London is, no doubt, exceedingly well-peopled, and by a strange variety of differing and opposing races. The very essence of our Protestantism is an honest toleration. The positive portion of our various creeds is honest, clear, and distinct enough. Our negatived side is also understood, and fiercely disputed about; but, however we may condemn heresies, and however strongly we may prize the truth, we still know how to keep our zeal under the control of reason, and to carry on our discussions, and fire off wordy discharges at each other without injury to life or limb. What is it to the majority of our people that Mr. Conway preaches a humane liberalism at South-place?—that Professor Huxley or Mr. Voysey teaches at St. George's Hall?—that the followers of Johanna Southcott meet at the house of a cooper in Westmoreland-road, Walworth?—that there are "Plumstead Peculiars," "Mediums," and heaven knows what beside? We believe they are all good citizens, who follow their occupations, pay their taxes, and pray on Sundays in their own way without interference by the law or by the lawless, who too frequently, under the influence of pious zeal, take the law into their own hands.

We by no means say that a right choice of religious faith is unimportant. The writer of this book in no way commits himself to any set of opinions beyond what his profession as a clergyman indicates. He describes, but never, fortunately for himself and his readers, argues. Hence the reader may trust himself with him very safely, and if he has the courage to do so he will find himself introduced into a very strange world of varied and conflicting opinion, quite interesting, and it may be added very necessary to be understood by all who take any interest in the special thoughts by which religious society in England is characterized.

Kenelm Chillingly: His Adventures and Opinions. By the author of "The Caxtons." Blackwood, Edinburgh and London. 3 vols.

There is always something interesting in "the last," whether word or act, of any great man. In the highest sense, Lord Lytton was not a great man, but there was something in his life and labours which greatly interested the public, and which, upon the whole, caused his labours to have more of an influence than either their power or originality entitled them to. His early poems, plays, and novels were cleverly, and sometimes brilliantly, rhetorical, but nothing more. We imagine that of all the poetry he has written, not two lines have ever been quoted as apt for the illustration of any human thought or situation; whilst those of his dramas which have kept the stage have seldom found readers in the closet, or excited admiration apart from the "scenery, machinery, and dresses" of the theatre.

Of his first novels much might be said in commendation, but very much more in censure. "Paul Clifford," with its dashing scenes and flippant paradoxes, was a pleasant contrast to the dull volumes of the day. Scott, after all, was a school in himself, and stood apart from others in the interest he excited. Outside Scott, however, Bulwer, as he was then called, offered great attraction to the ordinary visitor to the circulating library; and his "Eugene Aram," and other early books, though as false to life and fact as they well could be, were still exciting, and gave many a reader a sensation through the feeling who would in vain have sought for such a pleasure through the brain. It should be said, however, that this sensational or early style was greatly altered, if not entirely abandoned, in Lord Lytton's later works; and this now under notice, which has in it the last touches of the dying man's hand, may be favourably compared with even the best of the works given to the world even in his best days.

Kenelm Chillingly is a noble young fellow, whose fortunes it is interesting to follow; though, when he enters on ground with which experience has made us familiar, we cannot help discovering something rather stagey and unreal in the life depicted. The sketch of Chillingly miners is clever, but it is questionable whether a London editor ever carried about in his head such aphorisms as those treasured and shed abroad by Mivers, editor and proprietor of *The Londoner*. "Never tell people you are ill" is good advice in a sense, but not in the sense stated by Mivers. "Don't trouble other people with your ailments" is sound advice, but he must be a clever fellow who can follow Mivers's advice, and conceal them from himself. "If you want to keep young live in a metropolis" is no more true than the opposite, namely, if you want to get old live in a metropolis. "Don't be a family man, nothing ages one like matrimonial felicity and paternal ties." This is quite true if the wife is disagreeable, and the children unruly, but otherwise this piece of advice, as the sailors say, is only fit for the marines. A good deal of editor's wisdom is nonsense, but that is so commonly the case with London editors that few will be surprised at it in Mivers Chillingly. Much of the action of the story is natural enough, and the characters pleasant and amusing, though in a high sense never instructive. Lord Lytton tries to teach but in the best sense, either as to thought or life, he never can shine as a teacher whom it would be safe to follow. Some few of the poems really are good, thus, for instance—

The Flower Girl at the Crossing.

By the muddy crossing in the crowded streets
Stands a little maid with her basket full of posies,
Proffering all who pass her, choice of knitted sweets,
Tempting age with hearts-ease, courting youth with roses.
Age disdains the heart's-ease,
Youth rejects the roses;
London life is busy.
Who can stop for posies?

One man is too grave, another is too gay;
This man has his hot-house, that man, not a penny;
Flow'rets, too, are common in the month of May,
And the things most common least attract the many.
Ill on London crossings
Fares the sale of posies;
Age disdains the heart's-ease,
Youth rejects the roses.

Lily, the loving, sweet-tempered girl, is the gem of the book, which is well worth reading for her sake alone, and in the belief that she will find many admirers we commend her to the affectionate attention of our readers, and whatever we may think of the short-comings of Lord Lytton's volumes, we sincerely regret that the hand that penned them is still for ever.

Faust. A Tragedy by Goethe. Translated in Rhyme by C. Kegan Paul. London: King and Co.

It is a question fairly to be asked whether the non-German reader will ever get a satisfactory translation of "Faust?" Great poems are absolutely untranslatable, and "Faust" is, in almost every sense of the word, a great poem. The poet penetrates even to the "last recesses," thought, feeling, life. From the highest cogitations, which includes the almost boundless wonders of creation to the finest shade of individual feeling, begotten by the child on the mother's knee—from the blackest dreams of melancholy superstition to the brightest hopes of the limitless future—the imagination of the true poet penetrates; and in Goethe this wonderful all-including power, searches after the half-revealed and unrevealed, and until some poet, with a power almost equal to his own, shall follow his thoughts, and give them to us in the spirit and manner in which he would interpret nature herself, we shall never understand in its intensity, or feel in its beauty the wonderful world the great German poet has revealed to those who are qualified by a knowledge of German, and the feeling associated with the first lispings of language on a mother's knee, to follow him into those profound depths of thought, or to soar with him in those aerial flights where he moves on outspread pinions, and with an almost divine calmness.

Some few of Goethe's works have been well translated. Coleridge and Carlyle, in what they have done, have left little to be desired; but "Faust" has mastered all who have touched it. What Shelley might have accomplished had he been spared to go thoroughly through with the translation he began it is now difficult to say. What he has left is done in the best way; but it is to be feared that the quiet domestic homely passages would have lost much of their charm in our wild young English poet's hands. As matters stand, we have no adequate translation of "Faust." Dr. Anster's, which is by far the most readable, is not a close translation; whilst Blackie's, which is almost literal, is crank and unenjoyable. That by Lewis Filmore is done with loving fidelity and tenderness, but in the sublimer passages it lacks penetration of eye and sweep of wing. Mr. Kegan Paul has, however, tried, though without complete success, to unite the literal and the poetical, to give us the plain and the abstruse, and sometimes this is done in a manner that all but satisfies. A comparison or two from Mr. Paul's work with that of other writers will explain differences better than any amount of critical disquisition. Let us take the "Soldier's Song." Filmore's translation runs thus:—

Towns begirt with walls and moats,
Maids of proud and lofty thoughts—
Strong without and strong within—
These are what I love to win!
Bold is the attempt and hard,
But as noble the reward.

Summon'd by the trumpet's breath,
We go to rapture or to death;
For 'tis amid the battle's strife
Thrills the rush—the life of life!

Maiden's heart and city's wall
Were made to yield, were made to fall;
Bold is the attempt and hard,
But as noble the reward;
When we've held them each their day,
Soldier-like, we march away!

This is somewhat in Goethe's manner, but not much. Bayard Taylor, handling this trifle, does much better, there is more of the soldier's recklessness of spirit in it:—

Castles with lofty
Ramparts and towers,
Maidens disdainful
In beauties array,
Both shall be ours!
Bold is the venture,
Splendid the pay!

Lads, let the trumpets
For us be suing—
Calling to pleasure,
Calling to ruin.
Stormy our life is,
Such is its boon!

Maidens and castles
Capitulate soon.
Bold is the venture,
Splendid the pay!
And the soldiers go marching,
Marching away.

This has a good deal of the requisite audacity of spirit; indeed, it is the best of the

three; but we must allow Mr. Paul's to speak for itself, for although the song, at best, is but a trifle, we see most the defects or excellences of the artist's hand:—

Cities and tower,
  Walled o'er the plain,
Maidens with haughty,
  Scornful disdain,
These would I gain!
  Keen is the struggle,
Lordly the pay!
Rings out the bugle,
  Rousing us all,
Whether we conquer,
  Whether we fall.
This is a storming!
  That is a life.
Cities and maidens
  Yield in the strife.
Keen is the struggle,
  Lordly the pay!
Soon are the soldiers
  Up, marching away.

We cannot think that this new translation of Mr. Paul's will give the general reader any higher idea of Goethe's genius than he already has, but it is nevertheless so well done that it will repay the English admirers of the German poet to peruse it. Mr. Paul has done his work lovingly and well, and if he has not succeeded where all others have failed, the attempt, at least, is well made, and we have not the least doubt, though there are numberless translations of Goethe's masterpiece, this additional one will be welcomed by all who take a pleasure in the study of German literature. We have not touched the graver parts of the work, to do that would call for more space than we can conveniently give to a subject already worn to triteness by criticism.

The Enfield Iron Works and Inventions' Development Company, Limited.—Under this title a company has been formed, with offices, 101, Leadenhall-street, for the purpose of aiding inventors in the practical realization of their inventive projects. Time will show whether the undertaking will prove a success, but the name of Mr. Joseph Newton, A I C E, the justly esteemed President of the Association of Foremen Engineers, late of the Royal Mint, leads us to take a favourable view of its prospects, however, we think it will be found that success will be best attained by the company restricting its operations to certain classes of inventions. The whole field of invention seems too vast and varied for one company to deal with

THE COMBINED PORTABLE CAM LEVER PRINTING AND COPYING PRESS, WITH PRINTING OFFICE COMPLETE.

Everyone his own printer might appositely have been selected as the title of this invention, as it will be found to combine simplicity of construction, durability, and cheapness. It is admirably adapted for for the use of chemists, florists, professional men, merchants, bankers, stationers, steamship, railway and joint stock companies, hotels, music halls, restaurants, auctioneers, schools, missionaries, explorers, colonists, museums, the army and navy, and all tradesmen who require cards, invoices, circulars, labels, bills of fare, memorandums, addressed envelopes, hand-bills, &c.

By this "portable printing office," as it may be termed, every kind of printing can be done up to 13 inches by 8½ inches; it is, therefore, not a toy machine, but one of real practical use, the facts of which are fully substantiated by the very extensive sale it has had. Eight hundred having been manufactured and supplied since March 1872.

Her Majesty's Government, the Spanish, and several other Governments have, we are informed, patronized this invention, and, owing to its great usefulness and portability, have adopted it for their office and field uses, and it has been found to be of great service, both in despatch and economy, the whole arrangement being so simple that it is worked by the soldiers with ease and readiness both in camp and when on the march.

It is also highly appreciated for general office use in consequence of the peculiar advantage it has of being immediately converted into a powerful and superior copying press, as you have simply to remove the "type carriage" to admit the letter book.

They are so compact and portable that the whole printing office complete could stand in a recess of two or three feet square, and can be worked effectively in the same space.

This apparatus can be made to any size, and to suit the requirements of all trades, at proportionate prices, and can be manufactured with iron surfaces especially adapted for hot climates. The accompanying illustrations need no detailed description.

The agents for this invention are Messrs. Adutt, Finzi, and Co., 24, Mark-lane, London, E.C., sole manufacturers of the patent "Anti-Mildew Grain and Seed Protector," patronised by Her Majesty the Queen.

BLOTTING-PAPER MADE DOUBLY USEFUL.

Messrs. De Lara and Co., 154, Fleet-street, have patented a system by which account books, diaries, and other works of the same useful class, are interleaved and are more than doubled in value, without being increased in bulk or price—increased in value, because the blotting-paper, hitherto useless except as absorbing the surplus ink from the other pages, now contains important information and business notices, which no book of the kind had previously included. This result has been achieved by a peculiar preparation of the paper, so that, while losing nothing of its original value for blotting purposes, it offers an excellent surface for printing and becomes, in fact, a very considerable addition to the available contents of the book.

It was thought that all possible contrivances for the benefit of the advertiser had been exhausted—that ingenuity could find no other outlet for his announcements; but here is a new and vast field open for enterprise. The account book goes everywhere, into the hands of everybody. The tradesman issues a book to his customer; the customer has it at hand continually. When the account book at present in use is opened, on one side are the written entries, on the other a pink, spongy-looking blank, with a cross-hatching of blotted impressions, ugly to look at, and of interest to none. The new account book, patented by Messrs. De Lara and Co., is interesting on every page. The blotting traces of the well-used book are there indeed, but they cannot obscure the bright, legible information printed on the firm blotting-paper now in use. Printing-ink has beaten writing-ink ever since printing was invented, and it beats it now. Every time the book is opened, there is something which arrests the attention, some advertisement containing the information which it is desirable to possess—some business address, some intimation where to obtain an article of utility or ornament, which the housekeeper has been long desiring to know about, and which will not now be forgotten, because it will meet her eye half a dozen times a day.

Take in hand one of the books now furnished by tradesmen to their customers, or a private account book. There are perhaps thirty-two ruled pages for accounts, and there are also thirty-two pages of blotting-paper, which, except for mere blotting, is the veriest waste of waste substances. It cannot be written on, if a hasty memorandum is required; it is too rotten even for a spill to light the gas or cigar. It is a perfectly useless member of the paper community; and the poet Shelley, who had a mania for making and floating paper-boats, and once, in default of other material, folded up a five-pound note in the required shape, would have been in despair if he had only been in possession of a leaf of blotting-paper.

Messrs. De Lara believe their improvement will be appreciated by business men and careful domestic managers, who like to know what good things are obtainable, and where they are to be obtained. The new book is at once a household directory and a household price current. Immediately it was announced, the publishers were satisfied they had hit upon a good idea. Promises of support have, it appears, been received from every quarter, and advertisers were eager to secure a position in the pages.

Blotting-pads, to use a familiar phrase, "bristling with information," with monthly calendar, postal rates, tables of interest and wages, cab fares—everything, in fact, which can be desired for desk reference, are to be issued; and diaries, the most comprehensive and the cheapest ever offered, are in active preparation. The value of these books, increased in contents so greatly by the new process, without the slightest increase of price, is so obvious, that we confidently leave the matter to the attention of our readers.

The Scientific and Literary Review

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Editor's Office*: 21, *Cockspur Street, Charing Cross, S.W.

THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON.

ESTABLISHED 1ST MAY, 1862.

Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868.

LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES.

THURSDAY, JUNE 12.—A paper on "Bogs, and the Best Means of Making Them into Fuel, and Turning Them to profitable account by Drainage for Agricultural Purposes." By PETER LOVE, Esq., M.E., to be followed by discussion.

Monthly Notices.

The death of the late Mr. R. M. Latham, as already mentioned in the columns of our present issue, has been the principal topic of the month amongst inventors and members of the Inventors' Institute. It will be seen by reference to our report of the proceedings of the Institute, that a vote of sympathy and condolence to his widow has been passed by the Council and Annual General Meeting. This tribute is one fairly due to the memory of the deceased.

We have much pleasure in noticing the fact that a large meeting, at which Alderman Cotton presided, was held in Guildhall on the 20th May, with the view to promote the establishment of Tribunals of Commerce. The meeting was addressed by Mr. Lyne, the chairman of the Tribunals of Commerce Association, who for many years past has been working in behalf of the establishment of these Tribunals; also by Mr. F. W. Campin, the barrister, who stated that what was needed was the establishment of Tribunals, in which duly qualified commercial men should act as adjudicators and proceed to settle disputes between men of business in a summary and inexpensive way, upon the basis of trades customs and usages, without the cumbrous and costly procedure of courts of law, or adherence to antiquated precedents and legal figments. Not that the advice of lawyers upon legal points ought to be excluded from the operations of these Tribunals; but the legal element must be kept from being predominant, and rendered co-operative. He also advocated a department of Tribunals of Commerce, in which scientific and technical men should be called in as adjudicators for the settlement of disputes in patent cases. He remarked that in appointing adjudicators the Livery Guilds might be resorted to with advantage. Sir John Bennett, Mr. Griffith, Mr. Ex-Sheriff Hutton, and other gentlemen supported these views, and a committee to carry on operations in behalf of Tribunals of Commerce drawn from the persons attending the meeting was formed, of which Mr. J. R. Taylor is the Secretary.

The Inventors' Institute.

AT the usual meeting of the Council held previous to the ordinary members' meeting on Thursday, the 8th day of May, 1873, Mr. Hume Williams, Vice-Chairman of the Council, presided.

Mr. WILLIAMS, having taken the chair, stated that the principal business of the meeting was the consideration of some fitting expression of the feelings of the Council with reference to the death of the Secretary, Mr. R. Marsden Latham. He knew that all the members of the Institute must feel the deepest sorrow at the death of the late lamented Secretary. He (the Chairman) had been associated with Mr. Latham, in founding the Inventors' Institute, and had worked with him ever since. Mr. Latham was a most able Secretary, and it was mainly due to his intelligent action that the Inventors' Institute possessed the high position it now maintained. Under these circumstances he was sure that all present would feel desirous that some fitting acknowledgment of his services to the Society should be made. He concluded by stating that a resolution of condolence and sympathy with his widow ought to be prepared forthwith, and as this could not be well done at a meeting like the present, he thought the question should be referred to a Select Committee, whereupon

Mr. M. M. HARRIS proposed, and Mr. COULTHARD seconded, the following resolution:

"That Mr. Hume Williams, Mr. Campin, Mr. F. H. Varley, and Mr. Carttar be requested to frame such a resolution of condolence as may convey the sense of the Council and Institute of their appreciation of her late husband, and their deep sorrow for his loss."

This being put to the vote was carried unanimously.

Mr. HUME WILLIAMS then proposed, and Mr. F. H. VARLEY seconded, a resolution, that Mr. F. W. Campin be, and is hereby requested to accept the position of Secretary of the Institute, in the room of Mr. Latham, deceased, and that he be offered the same salary as that paid to Mr. Latham.

It being stated that the banking account, which stood in the names of Mr. Hume Williams, Mr. F. W. Campin, Mr. Coulthard, and others, could only be drawn upon by cheques, countersigned by the Secretary,

It was resolved that the bankers be requested, upon receiving cheques bearing the signatures of Mr. Campin and the other signatories, to duly pay the same without any cross signature.

It was also resolved that in consequence of the death of the late lamented Secretary of the Institute, and as a mark of respect to his memory, the ordinary members' meeting for the evening should be dispensed with.

At a council meeting held on 22nd May, previously to the general meeting, a resolution of condolence, as incorporated in the council's report, was passed as part of it.

The annual general meeting of the Inventors' Institute for the year ending May, 1873, was held at 4, St. Martin's-place at four o'clock p.m. on Thursday, 22nd of May, 1873, when Hume Williams, Esq., was unanimously voted to the chair.

The CHAIRMAN, in opening the proceedings, in eloquent terms, referred to the loss sustained by the Institute by the death of the late Secretary, Mr. Latham, who had, he might say, been called away in what appeared to be the very midst of a career of much usefulness and great promise, differing in this respect from the losses heretofore sustained by the association by the deaths of Sir David Brewster, the late President, Richard Roberts, C.E., and Professor McGauley, all of whom had been allowed by Providence a term of life more nearly approaching the allotted span of human existence. He concluded by remarking that Mr. Latham's death made it necessary that all members of the Institute should co-operate for the purpose of maintaining it on a good footing. He then called on Mr. CAMPIN, who acted as Secretary by direction of the Council, to read their report.

The report was then read. (See next page.)

On the motion of the CHAIRMAN, seconded by Mr. T. BLANCHETT, the report was unanimously received and adopted.

The CHAIRMAN then moved, and Mr. T BLANCHETT seconded, and Mr. D. J. MCLAUCHLIN supported, the appointment of Mr. F. W. Campin as Secretary of the Inventors' Institute, in the room of Mr. Latham, deceased, which was carried unanimously.

The Council for the last year were re-elected.

The auditors were re-elected.

It was then moved by Mr. MCLAUCHLIN, seconded by Mr. REGAN, that the thanks of the meeting are due, and are hereby accorded to Sir Antonio Brady, the Chairman, and the members of the Council for the past year, for their efficient services during the year of office.

Mr. HUME WILLIAMS then returned thanks on behalf of the Council, as also to a vote of thanks to himself for his conduct in the chair at the annual meeting, and with this the proceedings terminated.

ANNUAL REPORT OF THE COUNCIL OF THE INVENTORS' INSTITUTE, 1873.

The Council of the Inventors' Institute, in presenting the eleventh annual report, do so under a feeling of great depression. The recent decease of the lamented secretary, Mr. Robert Marsden Latham, who was also one of the founders of the Institute, has cast a gloom over them which they find it no easy task to dispel.

Moreover, the almost sudden death of the secretary, just at the time when the Annual Report should be in preparation, has not only deprived them of his able assistance in drawing it up, but has considerably hindered them in collecting and arranging those details of the progress of the Society, and the great questions it has to deal with, which they would feel it incumbent upon them to lay before the annual general meeting.

In the commencement of the present year, in May last, the subject of the Patent Laws was occupying much of their attention in consequence of the then recent publication, as a Parliamentary paper, of the Report, with the evidence, of the Select Committee of the House of Commons on Letters Patent for Inventions, which Report was printed *in extenso* in the numbers for June 1872, and Feburary 1873, of the journal of the Inventors' Institute (Scientific and Literary Review). This Report has led to much discussion at various meetings of the Council, and of the members of the Institute, and has been referred to a special sub-committee to consider and report *seriatim* on the various points raised in of the House of Commons Committee's Report. This sub-committee has held several meetings and considered the different paragraphs of the House of Commons Report; they have, however, delayed the completion and presentation of their own Report in consequence of the peculiar position of the Government on this question, it having been, in the first instance, communicated to the Secretary of the Institute by one of her Majesty's Law Officers that the Government did not intend to introduce any measure of Patent Reform into Parliament during the present Session; and afterwards it was confidently reported by Members of the House of Commons that the present Lord Chancellor (Lord Selborne) intended to bring forward a Bill in the House of Lords; but, now this intention appears to be abandoned. Lord Selborne being, however, a well-known declared opponent of any system of Patent Laws, the Council would take this occasion of warning inventors against placing any reliance on the assumed action or non-action of the Government as at present constituted, and any measure introduced by Lord Selborne the Council have no right to expect would be favourable to the inventor's interests. Further, it is evident that the present position of the Patent Law question is of a critical character necessitating the utmost watchfulness on the part of the Council and other members of the Institute and inventors generally, hence the Council would urge all friends of the inventors' cause to come forward and support this Institute in its efforts for the maintenance and protection of inventors' rights

Besides the great question of Patent Law the Institute has given much attention to various matters likely to interest inventors. At the usual fortnightly meetings of the members the following questions, amongst others, have been discussed:

Inventions relating to telegraphy, which formed the subject of a very able and interesting paper by Mr. F. H. Varley, F.R.A.S. (member of the Institute).

Technical education, by Mr. F. W. Campin.

On the bursting of pipes from the effects of frost, by Dr. J. A. Calantarients.

On Tribunals of Commerce as available for Patent adjudications, by Mr. J. R. Taylor.

These papers led to prolonged, and sometimes adjourned discussions, full reports of which will be found in the journal of the Inventors' Institute.

The approaching Patent Congress at Vienna formed the subject for consideration at some recent meetings of the Council and Institute, when it was agreed that delegates should be sent to represent the Society at that Congress.

The lamented death of Mr. Latham calls for the attention of the members of the Institute in regard to some testimonial to his worth and memory being accorded to his family, and the Council suggest the following resolution for adoption by the meeting.

"The Council and other members of the Inventors' Institute now assembled, hereby desire to present to Mrs. R. M. Latham the tribute of their heartfelt sympathy and condolence in the loss she has sustained by the death of her late husband, Robert Marsden Latham, Esq., secretary and one of the founders of this Institute. They feel that whilst she mourns over the loss of an estimable and beloved husband, the Institute has to deplore the departure from its midst of an officer and member who did much to give it that high rank it now holds amongst the institutions of the country."

The decease of Mr. Latham also calls attention to the question of supplying the vacancy in the office of Secretary, and the Council, at the last meeting, passed the following resolution:—"That Mr. Campin be requested to accept the position of Secretary of the Institute in room of Mr. Latham, and that he be offered the same salary as that paid to Mr. Latham." In accordance with this resolution Mr. Campin signified his intention of offering himself for election, and agreed to transact any business that required the attention of the Secretary till the general meeting

The audit of the accounts has, in consequence of the recent decease of the Secretary, been of a cursory character. The balance sheet, as presented, shows the position of the Institute, and the necessity of continued exertion on the part of the Executive in sustaining and improving its financial position The Council had arranged for the usual annual dinner, but the illness and death of the late Secretary has led to the abandonment of that project They hope, however, to be able to arrange for a dinner of the members and friends taking place early in the next Session.

THE IRONWORKS OF THE PHARAOHS.

An English gentleman, travelling in these parts (near Sinai), was struck with the small blue stones he discovered in the dried-up watercourses which in the rainy season convey the thousand streams that hurry to the sea, and, having the curiosity to bring some home, he soon discovered that they were turquoises of no common order. This determined him to make further researches. Eventually he has built a house near the junction of the Wady Kenuch, the Wady Mokatteb, or the written valley, and the Wady Megham. Here, aided by the friendly tribes he has taken into his pay, he has discovered the old turquoise mines of the ancient Egyptians, the rocks that they worked for the stones, the very tools they used, and their polishing and grinding places. Being a man of much energy, he has brought to bear upon this fortunate discovery, the advanced knowledge of our times, and he is obtaining and sending over to this country some of the finest specimens of turquoises that exist. In such a lonely spot, he naturally has not confined his attention to this subject only, but has traced out the system of fortifications by which the Pharaohs protected their works and workmen, and, what is still more wonderful, has come upon the remains of vast ironworks, so vast, indeed, that many thousand people must have been employed upon them, unless the plant used was on quite as grand a scale as that of our largest furnaces in the north of England. These works stand adjacent to the mines, on some hills at a place called Surabit-el-Khadin, and were evidently conducted on the Catalan system (in the opinion of their discoverer). The ore was very imperfectly extracted—slag brought over to this country, from the immense heaps that, like mountains, are piled around, contained as much as fifty three per cent. of iron. This district has remained unexplored, probably, on account of its being out of the beaten track; and in an unknown country, there is no temptation to stray, particularly as the guides and dragomen discourage any explorations which may add to the risk of the journey. It is, however, much to be desired, that, now that attention is directed to the locality, and moreover, since the thorough investigation of its sites is likely to prove exceedingly profitable, that the enterprise and desire for knowledge of our scientific explorers may find help from the ready hand of some of our commercial magnates, and thus, that a past book in the world's history may, by English perseverance, be re-opened.—*Iron.*

MAN ENGINES.

For the purpose of lifting the miners out of deep mines without the use of rope and kibble, man engines were invented forty years ago by Bergmaster Dörrell, of Clausthal, in the Upper Harz, when he used two pump rods, which, side by side, went up and down a shaft, and fixed to them small platforms and handles at all those points of the rods which came opposite after every stroke. So, by simply changing his stand after each stroke, from one rod to the other, a man would be lifted up to the surface without any exertion. This ingenious system, says a correspondent of engineering, was soon imitated in other parts of Germany, Belgium, France, and England, and generally special machinery was designed to drive these man engines. At the deep silver lead mines of Przibram, in Bohemia, since 1854, in the Maria shaft, a direct acting man engine, with two steam cylinders and cataract reversing gear, has been employed, both rods being connected by chains which run over pulleys; the great wear and tear of the latter, however, the great pressure of steam required, the inequality of the engine stroke when differently loaded, and other inconveniences, caused this direct acting engine to be abandoned and replaced by another indirect acting man engine in the Anna shaft. This latter was constructed so as to transmit the up and down motion from a rotating crank by two pump crosses—by-the-bye, exactly the same principle which was originally employed by the inventor. This system is now quite successful at Przibram, and a small condensing steam engine, working expansively, is quite sufficient to work it with the greatest safety and regularity, a brake attached to the flywheel controlling the engine with certainty whenever required. The engine reaches a depth of 400 fathoms, and 3,000 men go up and down it daily, in about nine hours (three hours for each shift); it makes four to five strokes per minute of 10 ft. each, requires 6·2 to 6·9 lbs. of coal per hour, and per effective horse power, and costs from 2s. to 2s. 3d. per horse power in twenty-four hours. Quite recently the old engine in the Maria shaft has been also replaced by a similar one, only the stroke of the rods has been increased to 12 ft.—*Scientific American.*

We recommend to the notice of our commercial friends the "Planters' Gazette and Commercial News," full notice of which will be found in our advertising columns.

Proceedings of Societies.

THE INSTITUTION OF CIVIL ENGINEERS.

April 29th, 1873.—T. Hawksley, Esq., President, in the chair. The paper read was "On the Rigi Railway," by Dr. William Pole, F.R.S., M. Inst. C.E. This communication was written in consequence of a suggestion from the council, that members travelling abroad would do well to communicate to the Institution information as to any remarkable engineering works they might meet with in foreign countries; the author accordingly offered a short account of a railway he had lately seen in Switzerland of a peculiar character. The object of this railway was to convey passengers to the top of the Rigi, a mountain near Lucerne, from which there was a view so celebrated as to attract large numbers of visitors in the summer months. There was no carriage road, and the only means of ascent had hitherto been either by walking, or by horses, or by *chaises à porteurs*. A few years ago M. Riggenbach, the superintendent of the railway workshops at Olten, proposed to make a railway to the summit; but, on account of the great height, 4,500 feet above the plain, an unusually steep gradient, about 1 in 4, was necessary. There were objections to the use of stationary power, and M. Riggenbach devised a means of ascending by a rack and pinion arrangement, similar to that proposed and constructed by Mr. Blenkinsop in 1811, in the infancy of railways. The necessary concessions were obtained from the Cantonal Governments, and as the money was readily to be had, the railway was commenced in 1869. It was delayed during the French war of 1870, by the non-delivery of some rails ordered in that country, but it was opened for work in 1871. The line commenced at Vitznau, on the Lake of Lucerne, and was about 4 miles long. There was nothing remarkable in the works, which were mostly formed by cutting and benching on the rocky slope of the mountain. There was but one short tunnel, and only one iron bridge over a ravine. The gauge was 4 feet 8½ inches, and the rails were of the Vignoles shape, weighing 31 lbs. to the yard; a good example of a light railway on a standard gauge. The rack was placed midway between the rails, and was formed of two wrought-iron cheek plates, having wrought-iron teeth inserted between them, and riveted on each side. The pitch was nearly 4 inches. The locomotive weighed about 12 tons, and was supported on four wheels. The boiler was vertical, and its axis was inclined to the base line, so as to be nearly upright when running on the steep gradient. The crank shaft worked by gearing to the main axle, on which the cog-wheel was placed. This wheel was about 25 inches in diameter, and was formed of the best cast steel, the teeth being carefully shaped by machinery. Only one carriage was attached to each train; this was 28½ feet long, by 10 feet wide, and held fifty-four passengers.

The author minutely described the precautions taken to provide against the danger of accident, as these formed the most prominent features of the plan. In the first place the speed was very slow, not exceeding 3 or 4 miles per hour, either up or down. At this speed all the numerous risks of damage which resulted from velocity of motion entirely disappeared. The danger of getting off the rails (which with precipices of thousands of feet close alongside would be most formidable) was met by clips fastened to the vehicles, which passed under the rack bar, and would, if the wheels should run off, prevent the carriages from getting away. The risk of running down could not be met by breaks of the ordinary kind, as the friction would be ineffective on such a steep incline. Accordingly clip-breaks were provided, which embraced drums on the cogged wheel axles, so that when these clips were tightened, the cogs held fast in the rack, and thus supported the weight of the vehicle. There were two of these breaks to the engine, and one to the carriage. The carriage was not coupled to the engine, but was pushed before it in ascending, and ran down behind it by its own weight in descending; if, therefore, anything should happen to the engine, the carriage was free, and could be held safely in its place. An ingenious break of another kind was also used in descending. It was a mode of acting on the pistons by a peculiar arrangement of valves in the passages, which allowed the pistons to draw air into the cylinders, and to compress it on the return stroke before it escaped. The degree of this compression could be varied at pleasure by adjusting the escape cocks, and in this way alone a perfect control was exercised over the descent of the train.

In the summer of 1872, the railway carried about 87,000 passengers without any accident or derangement, and it was considered a perfect success. It had cost, including improvements made since its establishment, about £60,000, and it had paid £15 per cent. interest, in addition to a large allowance put aside for a reserve fund.

May 6th, 1873.—T. Hawksley, Esq., President, in the chair. The paper read was a history of "The River Clyde," by Mr James Deas, M. Inst. C.E., and gave an account of the various works carried out for improving it as a navigable river, and of the modes and cost of dredging and depositing followed in the deepening and widening of it.

It was remarked, that for no river in the kingdom had so much been done "by art and man's device" as for the Clyde above Port-Glasgow; that the river from Glasgow for 12 miles seaward, was nearly as much an artificial navigation as the Suez Canal, and required constant dredging to maintain it, while the ever-increasing size of the vessels of the mercantile navy rendered necessary the constant deepening of the river to enable the navigation to keep pace with the demands of the shipping trade. One hundred years ago the river was fordable even on foot 12 miles below Glasgow.

The engineering works carried out in the Clyde, combined with the mineral resources of the district, had raised Glasgow from an insignificant provincial town, with a population in 1771 of only 35,000, to be the second city in the empire, with a population (including suburbs) of 566 150 according to the census of 1871. The banks of the Clyde were now the seat of the largest ship-building trade in the world. The first steps were taken by the magistrates of Glasgow in 1755, when Smeaton was employed to report as to the improvement of the river. Golborne, of Chester, reported in 1768; James Watt in 1769; Rennie in 1799, 1807 and 1809, Telford in 1806, 1819, 1821 and 1826, and subsequently, engineers of the highest eminence had been consulted. Smeaton, in 1755, found there were twelve different shoals between Glasgow and Renfrew, the two shallowest places being at the present western boundary of the harbour of Glasgow,—where the river was 1 foot 3 inches deep at low water and 3 feet 8 inches deep at high water,—and at a point then within the harbour, where it was 1 foot 6 inches at low water and 3 feet 3 inches at high water. There was now a depth of 14 feet at low water and of 24 feet at high water at each of those places. Ordinary neap tides were then only sensible at Glasgow. Smeaton recommended that a lock and a dam should be constructed 4 miles below Glasgow, in order to secure a depth of 4½ feet of water at all times up to the quay at Glasgow. The lock was to be 18 feet wide, and capable of taking in a vessel of 70 feet in length. Fortunately no lock and dam were constructed, and the first improvement of the navigation was effected by Golborne, who, in 1768, inaugurated the system of contracting the river by the construction of rubble jetties, and of the removal of the shoals by dredging and ploughing. In 1799, Mr. Rennie recommended the construction of new jetties, and the building of low rubble walls from point to point of the jetties. Two hundred jetties, varying in length from 50 feet to 550 feet, were built. In 1806 Telford recommended the completion of the parallel dykes begun on the recommendation of Rennie, the bringing of the river to a uniform width, and the formation of a towing-path from Renfrew to Glasgow. He disapproved of the quays along the river, and recommended the conversion of a portion of the present bed of the river into a wet dock, and the making of a new channel for the river. This advice was not followed, but as the traffic increased, quays were extended along both sides of the river. From 1807 till the end of 1835, when Walker was appointed engineer, deepening, widening and straightening were continuously carried on. In Walker's first report to the trustees, he stated that there was then a depth of 7 feet to 8 feet at low water at Glasgow, while the lift of a neap tide, which was only sensible in 1755, was 4 feet, and of a spring tide 7 feet or 8 feet, making a depth of 12 feet at high water of a neap tide, and of 15 feet of a spring tide. Scott Russell, in 1837, spent several weeks in carrying out a minute and elaborate series of tidal observations. He found that spring tides rose and fell about 11 feet at Port-Glasgow, and about 7 feet at Glasgow, neap tides rising 6 feet and 4¼ feet at those places respectively. The tides now rose about the same at Port-Glasgow, but at Glasgow the spring tides rose 10½ feet, and neap tides 9¼ feet. He also found that the time of high water was 83 minutes later at Glasgow than at Port-Glasgow; now it was only 65 minutes later. In 1800 it was 3 hours later at Glasgow than at Port-Glasgow. The time of low water at Glasgow was at present 1 hour and 40 minutes later than at Port-Glasgow. In Glasgow Harbour the tide flows for about 5 hours 40 minutes, and ebbs for about 6 hours 50 minutes, at Port-Glasgow the tide flows for about 6 hours 15 minutes, and ebbs for about 7 hours 2 minutes.

In 1840 was passed an Act, founded on plans prepared by Walker, in which lines, defining both sides of the river when improved, were laid down; and on those lines, with slight modifications at one or two places, to meet the wishes of riparian proprietors, the improvements in the river had been since carried out. Notwithstanding the great changes in the river previous to the passing of that Act, the width of the river above Napier's Dock, in Glasgow Harbour, was then only 168 feet; now it was 410 feet, and vessels of 3,000 tons burthen floated where at that time stood one of the largest cotton mills in the city. Before the river was improved, inundations of the low-lying part of the city of Glasgow were frequent, and engaged the attention of Rennie in 1799 and 1807, and of Walker in 1836. The straightening of the river and the enlargement of its sectional area had put an end to these inundations. In 1830 the greatest draught of vessel that could be navigated safely to Glasgow was 15 feet; in 1839, 17 feet; in 1854, 19 feet; in 1861, 21 feet; and in 1870, 22 feet.

Since 1758 there had been a gradual lowering of the low-water level in the harbour of Glasgow to the extent of nearly 9 feet, 13 inches of this depression having taken place since 1853. The results were not entirely beneficial: quay walls built even as late as twenty years ago were founded too high for the altered level of low water, and the necessity of greater depth of water to suit the class of large vessels now building, had made the walls show a tendency to slip into the river.

Docks were recommended by Telford, Rennie, Clark, Hartley, Logan, Walker,

Brammer and Ure; and Acts for such were obtained in 1840, 1846 and 1870. Until recently the sides of the river afforded sufficient scope for quay extension. The first, and as yet only, dock was opened in 1868. This was a tidal dock having 5½ acres of water-space, and 830 lineal yards of quay. The construction of Stobcross Docks, authorized in 1870, was now begun. These docks would have nearly 30 acres of water space, 30 acres of quayage, 3,100 lineal yards of quays, and would accommodate 1,000,000 tons of shipping per annum at an estimated cost of £1,163,000. The quayage in Glasgow Harbour was at present 4,774 lineal yards, exclusive of 830 lineal yards surrounding the dock already referred to; 2,782 yards being on the north, and 1,992 yards on the south side of the river. An additional length of 400 yards on each side of the river was nearly ready for use. The water-space of the portion of the river between the quays was about 70 acres.

There were no public graving docks on the Clyde above Port-Glasgow; but the Clyde trustees were constructing one at Glasgow, 560 feet long, 72 feet in width of entrance, and having 22 feet depth of water at ordinary spring tides. In 1850, a dock of this description, 500 feet in length, was completed for Messrs. Todd and McGregor. At Dumbarton there was one private dock 300 feet long. Port-Glasgow had had a public graving dock since 1762, constructed from the designs of James Watt. Greenock possessed five, Ardrossan one, and Troon two graving docks.

The first Act for the improvement of the River Clyde was passed in 1759. The first steamer, the *Comet*, was built in 1811-12, and by 1818 passenger steamers were numerous on the river. Fly-boats for passengers, propelled by sails and oars, were used before the introduction of steam-boats. Till the year 1818 none of the vessels in the foreign trade came farther up the river than Greenock.

A variety of appliances had been employed in the deepening and widening of the Clyde. The sand banks, when dry at low water, were broken up by common land ploughs, drawn by horses, so that the current might carry the sand away. Another description of plough, much used, consisted of a front plate of iron and two sides of timber; the front plate being armed with prongs when gravel banks were to be operated on. These ploughs were fitted with sling chains at each end, were wrought in pairs by hand capstans, two of which were placed on the river bank, and two on a punt moored in the river on the opposite side of the bank to be removed, and were hauled through the sand bank with their loads, which were removed at low water on to the adjoining land. Harrowing even was had recourse to, a harrow being attached by tackle to the stern of a tug steamer, which set off with the tide, tearing up the bottom as far as requisite, the harrow was then raised, the vessel steamed back against the tide, and the operation was repeated. Dredgers, with small buckets on a ladder, wrought by hand and by horses, succeeded the ploughs and harrows, and in 1824 the first steam-dredger was started. It dredged only to the depth of 10½ feet, whereas now several of the dredgers could work in a depth of nearly 30 feet of water. The cost of dredging varied much, according to the character of the material to be lifted, to the power of the dredger, and to the capacity of the buckets. As the material dredged from the Clyde varied from silt and sewage deposit to the hardest gravel and boulders, completely concreted together, it was evident there must be a corresponding range in the cost per cubic yard of dredging. As an example of good work, it was stated that one of the two most powerful of the trustee's dredgers lifted on each of five consecutive days, in the month of August, 1872, 2,240 cubic yards of material, or about 3,600 tons; the engine working 9 hours the first day, 9¾ hours the second, third, and fifth days, and 9½ hours on the fourth day; the average strokes of the engine were 33 per minute, the average depth of water the points of the buckets were working at, 20 feet. Dredging was carried on in the Clyde all through the year, 2,400 hours average working time being performed by each dredger per annum. Repairs formed a heavy item in the working expenses of a dredger. An hour each day on the average was consumed in replacing pins, links, and buckets, and nearly every year each dredger was laid up for several weeks undergoing a thorough overhaul.

Occasionally the deposit was removed sufficiently far from the front of the quays to enable the bucket dredgers to work by spooning. The spoon was a large pronged spade with a straight handle about 50 feet long. The spoons were wrought in pairs by hand crab winches, two on the quay and two on a punt moored in the river. One man held the handle of each at the edge of the quay, and one set of three men on the quay, and another set of three on the punt worked in spoons alternately, from the face outwards and back again for a fresh spoonful.

Boulders, weighing as much as 17½ cwts., were occasionally lifted by the dredgers, but diving bells were constantly employed lifting boulders, some of which weighed upwards of 6 tons. The most important work, however, performed by the diving bells during the last twenty years had been the removal of a bed or dyke of trap rock about four miles below Glasgow. This rock was accidentally discovered in 1852 by one of the first line of steamers started between Glasgow and New York grounding on it. The rock extended over the bed of the river for about 900 feet in length by about 300 feet in breadth. Blasting by gunpowder, fired by an electric battery, had, at a cost of upwards of £16,000, removed the rock over half the channel, so as to give a depth of 14 feet at low water, the other half having an available depth of 8 feet at low water.

Up till the year 1862 the whole of the dredged material was deposited on land at a cost in 1861 of 10·37 pence per cubic yard for depositing alone, exclusive of interest on cost of, or allowance for depreciation of plant. Many acres of alveus thus reclaimed became the property of the riparian proprietors, who now asked from £1,200 to £1,400 per acre for it. In 1860 the trustees introduced steam hopper-barges for the purpose of conveying the material to sea. The result of working for the year ending the 30th of June, 1871, was that the cost of conveying 673,240 cubic yards to, and depositing them in Loch Long, 27 miles from Glasgow, was £15,323 8s. 2d., or 5·46 pence per cubic yard, 1·84 penny of the said rate being 10 per cent. on the value of the barges for interest and depreciation; while for 122,664 cubic yards deposited on land the cost was 16·40 pence per cubic yard, 3·52 pence per cubic yard being 10 per cent on the value of the punts for interest and depreciation. In the twelve months referred to 904,104 cubic yards, or about 1,130,000 tons, were dredged from the harbour and river, of which 689,560 cubic yards were carried to sea, and 214,544 cubic yards were deposited on land. Of that quantity 345,209 cubic yards were considered deposit, and 558,895 cubic yards new material. During the last twenty-eight years 14,600,000 cubic yards, or upwards of 18,250,000 tons, had been dredged from the river by the Clyde trustees.

The trustees' dredging plant consisted of six steam-dredgers, fourteen steam hopper-barges, one steam-tug, three diving bells, two hundred and seventy punts and numerous small boats, one dredger and four hopper-barges having been added in the summer of 1871. The value of the plant was £140,000. In 1867 the trustees, at a cost of £25,000, erected at Dalmuir, 8 miles below Glasgow, works for the repair of their plant, including a patent slip to accommodate their largest dredger. One hundred and forty hands were constantly employed.

From Glasgow to below the mouth of the River Cart, on the north side, and to near Erskine Ferry, on the south side, the river dykes had all been removed, and for that length the river flowed through land now above the level of high water, much of which had been raised to that level by material dredged from the river. The slopes of the banks were 1½ horizontal to 1 vertical, and were covered with whinstone rubble. Until within the last four years when the author became the engineer of the navigation, the stones were hand pitched, at a cost for labour alone of 1s. 2d. per square yard; since then pitching had been discontinued, and the stones left rough as laid on. The slopes stood better, and the waves raised by steamers were more effectually broken. A coating of stones 12 inches in average thickness effectually protected the slopes for months.

The total expenditure of the trustees since 1770 had been £5,594,981 14s. 8d.; of which a sum of £1,390,947 18s. was for interest on borrowed money, £721,453 8s. 3d. for land for the enlargement of the harbour, and £164,838 for land for widening the river below the harbour. The whole expenditure had been paid out of the rates and by money borrowed on the security of these. The total debt of the trust at the 30th June, 1872, amounted to £2,151,557 8s. 3d.

At the monthly ballot the following candidates were duly elected associates:—Messrs. F. H. Ashurst, Stud. Inst. C.E., W. T. Bourne, P. J. Bruff, T. A. Bulkeley, W. L. Crawford, T. C. Ellis, Stud. Inst. C.E., R. G. Elwes, E. Field, A. H. Ford, Lieut.-Col. W. H. Gulliver, R.E., Messrs. S. Harpur, L. Heath, Stud. Inst. C.E., J. Kyle, E. J. Lynch, R. K. MacBride, F. D. Mitchell, C. Prouse, jun., A. E. Schmid, J. S. Sworder, J. L. F. Target, T. Vernon, and O. York.

It was announced that the Council, acting under the provisions of the bye-laws, had transferred Messrs I. L. Bell, A. S. Hamand, and A. H. Kessner from the class of associates to that of members, and had admitted Messrs A. E. Baldwin, R. E. Dunstan, and W. Thomas, as students.

May 13, 1873.—T. Hawksley, Esq., President, in the chair. —The paper read, "On the Delta of the Danube, and the Provisional Works executed at the Sulina Mouth," by Sir Charles Augustus Hartley, M. Inst. C.E., was a sequel to a previous communication by the author on March 11, 1872. It described the mutations of the Sulina Bar from 1861 to the present time, and referred to the changes in the sea outline of the Delta during 16 years.

When it was found that the piers, previously described, had maintained an additional depth of water on the bar of from 6ft. to 8ft. for five years after their completion, and that sufficient funds could not be obtained for the improvement of the St. George's branch, the Commission, in 1866, adopted the author's project for the conversion of the Sulina piers into solid structures, and the works were completed in the autumn of 1871. The provisional piers had already been fully described in the author's first paper. They consisted of three rows of piles, the outermost rows being of close piling, on either side of which stones of less than a cubic foot in size were thrown from barges and allowed to take their natural slope up to the water line. During the five years which succeeded, the waves broke down the ridge of stonework to the level of from 3ft. to 4ft. below the water line, and the sea and inner slopes were reduced to 2½ to 1, and 1½ to 1 respectively. The problem was, how best to build in an open sea-way a solid wall 1½ mile long, 10ft. thick, and of nearly the same height, from an irregular foundation of *pierre perdue* to the

level of the fast-rotting timber superstructure. At first the wall was built on a roughly levelled foundation, by lowering masses of unset concrete, within moveable timber dams fitted, in lengths of from 15 to 30ft., to the framework of the piers. The earlier trials were unfortunate, from the proportion of cement mixed with the sand and gravel being insufficient to insure the stability of the blocks under water, and some 35-ton blocks at the pier-head, where the proportion of cement to gravel was only 1 to 4½, succumbed to the force of the winter gales. Ultimately, by the end of the summer of 1868, a length of 2,791ft. of the North Pier was successfully completed, the proportion of cement to the sand and gravel being 1 to 3 in the immersed portion of the wall, and 1 to 6 in the part above water. But although the progress of the works had been hitherto satisfactory, increasing difficulties and expense were met with in the rougher water seaward, and this induced the author, in the spring of 1869, to adopt an alternative plan for consolidating the seaward end of the piers, by carrying up the wall from a foundation on the rock work carefully levelled by hand. Accordingly, a perfectly level bed at the depth of 5ft. over a width of 12ft., on the river side of the sheet piling, was executed by Russian divers for the next 1,247ft. of the North Pier. To afford greater security to the foundations, four 3-inch oak planks were spiked to the open piling which formed the inner row of the provisional piers, the lowest plank being fixed at 7ft. 6in. below the water line. On the foundation thus prepared, blocks, weighing 18 tons each, composed of 1 of cement to 7 of sand and gravel, were lowered from the timber platform above to their destined site, by powerful "goliaths." As each block was 5ft. wide, and the distance between the quintuple rows of piles was 7ft. 6in., the interval between the blocks along the line of works was 2ft. 6in. The blocks were lowered when ten days old, and the spaces between them immediately filled up with newly made concrete, which ultimately consolidated the whole mass. In 1869 the consolidation of the North Pier was carried out to 3,200ft. from the shore, and the South Pier was consolidated for a length of 690ft. on the plan first adopted at the North Pier. In this year steam machinery was erected on shore for the construction of blocks of from 10 tons to 20 tons each, which were afterwards thrown from pontoons at random on the outer slope of the rock-work adjacent to the head of the North Pier, where the waves were found to level down the ordinary *pierre perdue*. In 1870, the remaining length of 1,438ft. of the North Pier was consolidated, and a new iron lighthouse was erected and fitted with a fourth class dioptric light. The consolidation of the South Pier was also completed up to the high-water line in 1870, but its crown-work was not finished till the summer of the following year. The composition of the concrete for different parts of the works was then described, and the quality of the puzzolana and cement.

The total sum expended on the Sulina Piers, of which the north was 5,332ft. long, and the south 3,457ft., amounted to £185,332 on 30th September, 1871, when the works were entirely finished. In 1857, before it was decided to try the effect of temporary works, the lowest engineer's estimate for permanent works was £307,200, and the highest £384,000, so that the tentative works in the first instance, and their subsequent consolidation as described, had been carried out at only one-half the amount estimated in the original projects. Moreover, it was thought that the execution of these projects would occupy nine years, and that by them the depth on the bar would only be increased to 16ft., whereas the present depth of the navigation was 20ft. The piles used in the construction and strengthening of the provisional works were as sound below the water-line as when first driven, and to this the author attributed the stability as well as the comparatively slight cost of the works as now completed.

When the European Commission of the Danube began its labours in 1856, the entrance to the Sulina branch was a wild open sea-board strewn with wrecks; the depth of channel was rarely more than 9ft. The site, now occupied by wide quays raised high above flood level and more than two miles in length, was entirely covered with water when the sea rose a few inches above the ordinary level; and in the summer of 1857 three months of constant dredging and raking on the bar produced no appreciable effect. On the completion of the provisional piers, in 1861, the depth of water on the bar increased to 17ft., and the Sulina at once took the highest rank among the best commercial harbours in the Black Sea. The subsequent changes in the depth of the bar channel were then detailed, and the formation of sand banks off the pier heads. In June, 1864, the author recommended the Commission to prolong the South Pier, for the following reasons:—

1. Experience had taught that between the piers the channel had kept itself at the normal width of 580ft. and depth of 17ft., by the ordinary action of the river current.

2. It had shown, also, that low summer floods did not produce scour enough to carry away the deposits, formed during low water in the river, beyond the parallelism of the piers.

3. It was also proved that the action of the sea on the bottom during storms swept away the banks deposited in calm weather beyond the North Pier head.

4. The projection of the sandbank, immediately off the South Pier head, had become so considerable that the entrance was only very slightly protected by the North Pier during the prevailing N.N.E. winds, and thus the extra length of 650ft. given to the windward pier, beyond the South Pier, principally to afford this shelter, was no longer of much use.

5. The new sandbank itself was as much in the way of vessels entering and leaving the port as would be a solid work of timber and stone carried from the South Pier head to a point directly opposite the North Pier head.

The most sudden shoaling of the water on the Bar occurred between the 7th and 12th of April, 1866. On the former day the depth of water was 17¾ feet, on the latter 14 feet. This sudden deterioration in the depth was accounted for by the wind blowing into the mouth of the river from the east, and across it from the south, at a time when the current was feeble and the river heavily charged with alluvia. On the 25th of the same month, after a strong gale of three days' duration from the N.E., the channel had again deepened to 16½ feet. In 1867 it became necessary to prolong the North Pier landwards, to keep pace with the erosion of the north shore, and to preserve the continuity of the roadway between the pier and the land. In 1869 there were no river floods, and sandbanks again interfered with the entrance, to such an extent, that in July it was resolved to carry out at once the author's recommendation of prolonging the South Pier, so that the overlap of the North Pier, being reduced to 150 feet, the fluvial deposits might be thrown down beyond the head of this pier instead of under its shelter, as heretofore. By November the total length of the South Pier prolongation, viz., 457 feet, was nearly completed, and the beneficial effect became apparent on the recurrence of floods in 1870; as the profitable depth of the channel increased to 19 feet, the depth at the entrance being 22 feet. Finally, after the completion of the works, in 1872, a profitable depth of 20 feet was attained.

With reference to the practical results which followed the deepening of the Sulina Mouth from 9 feet in 1857 to 20 feet in 1872, it was stated that in 1853, 2,490 vessels, measuring 339,457 tons left the port; in 1869, 2,881 vessels, measuring 676,990 tons. The reduction of the number of wrecks had been from an average of 39 in 10,000 leaving the river from 1853 to 1860, to an average of 8 in 10,000 from 1861 to 1869, and of 2 in 10,000 since 1870. The charges on vessels had also been reduced from 2 to 3 francs per quarter for lightering grain across the Bar, in 1857, to 2 francs per register ton for port dues at the present time.

Recent changes along the shores of the Delta were then described. It appeared that the projection of the piers at the Sulina Mouth had had the effect of greatly deepening the sea bottom to the north of the piers between the shore and soundings of 18 feet, and of accelerating the shoaling of the sea bottom to the south of the piers over the same depth. On the other hand, the works had retarded the growth of banks at 24 feet and 30 feet, as their advance eastward to the north and south of the piers, and in front of them, during the ten years ending November, 1871, had only been 44 feet a year, whereas in the twenty-eight years immediately preceding the beginning of the works, the same contour lines had advanced at the rate of 97 feet a year. The author attributed the slower advance of the delta to the circumstance that the great bulk of the silt-bearing waters of the river, on issuing at once into deep water beyond the pier heads, was carried far to the south-east by the littoral current instead of flowing into the sea, as formerly, with a feeble and constantly decreasing current, by numerous shallow channels. The local growth of the south sandbanks was evidently due to the shelter afforded by the piers from the prevailing winds, which encouraged a more rapid precipitation of solid matter from the turbid waters escaping laterally in a south-west direction after rounding the South Pier head. The erosion to the north of the piers was probably occasioned by the rebound of the sea against the North Pier during heavy north and north-east gales.

Reference was made to the enormous growth of the northern part of the Kilia Delta in recent years, due to the greatly augmented volume of water which had lately flowed to the sea by the Ochakoff branch and New Stamboul Mouth; while a diminution in the advance of the southern extremity of the Kilia Delta was assigned to the impoverishment of the Old Stamboul branch of the river. These changes, from natural causes, in the relative volumes of water delivered to the sea by the Kilia Mouths, were favourable circumstances in considering the problem of the number of years that would probably elapse before the Sulina Mouth would be absorbed in the shallows of the Kilia Delta. Since 1857, owing to the shoaling of the Toultcha and the St. George's branches, the outflow by the Kilia had increased, so that it now delivered two thirds of the whole volume of the Danube to the sea. Fortunately for the navigation by the Sulina Mouth, the larger portion of the detritus was transported far to sea, and comparatively little went to swell the shallows of the Kilia Mouths. In the last fifteen years the advance of the 30-feet line of soundings had been strictly confined to the sandbanks facing the mouths of the Kilia, Sulina and St. George, and it was shown that an erosive action had been long at work on the shore line and sea bottom to the north and south of the Sulina Mouth.

ZOOLOGICAL SOCIETY OF LONDON.

MAY 6TH, 1873.—*Professor Newton, F.R.S.*, vice-president, in the chair.—The secretary read a report on the additions that had been made to the society's menagerie during the months of March and April, 1873, and called particular attention to an example of the Broad Banded Armadillo (*Xenurus uni-*

cinctus), purchased 8th April, which was new to the society's collection; also to a pair of White Necked Cranes (*Grus vipio*) from Japan, purchased 17th April. No examples of this fine species, so far as was known, had previously been brought alive to Europe. Mr Sclater exhibited some photographs of, and made remarks on, a young specimen of the Liberian Hippopotamus (*Hippopotamus liberiensis*) which had recently been received alive by the Zoological Society of Ireland, but had died shortly after its arrival. A communication was read from the Rev. O. P. Cambridge on some new species of Araneidea, chiefly from Oriental Siberia. A communication was read from Mr. G. B. Sowerby, jun., on three species of Land Shells from Madagascar, which he proposed to call *Cyclostoma suffusum*, *C. vexillum*, and *C. perspectivum*, sps. nov. A communication by Messrs. P. L. Sclater and O. Salvin contained notes on the range of certain species of American *Limicolæ* in the southern part of the New World. Two distinct species of Stilts (*Himantopus*) were shown to occur in the Neotropical Region—namely, *H. nigricollis*, Vieill. and *H. brasiliensis*, Brehm. Mr. A. H. Garrod read a memoir on the variations of the carotid arteries of birds, in continuation of the labours of Bauer, Meckel, and Nitzsch upon this subject. Mr Garrod's observations were based principally upon specimens that died in the society's gardens.

The next meeting of the society for scientific business will be held at the Society's House, in Hanover Square, on Tuesday, the 20th of May, 1873, at half-past eight o clock, p.m., when the following communications will be made:—1. Sir Victor Brook, Bart. On African buffaloes. (Received 18th March, 1873.) 2. Lord Arthur Russell Remarks on varieties of the Carp. 3 Mr St. George Mivart. On Lepidemur cheirgaleus, and on the Zoological rank of the *Lemuroidea*. (Received 15th April, 1873.) The following communications remain on hand:—1—Lord Walsingham On the different species of Deer and other ruminants in Oregon and Northern California. (Received 18th April, 1873.) 2.—Messrs. P L. Sclater and O Salvin—On some Venezuelan Birds collected by Mr. James M. Spence. (Received 30th April, 1873.) 3 Mr. R Swinhoe—On the White Stork of Japan. (Received 5th May, 1873).

SOCIETY OF BIBLICAL ARCHÆOLOGY.

TUESDAY, MAY 6, 1873. Dr. Birch, F S A., F.R.S.L., President, in the chair. The following candidates were duly elected Members of the Society.—Signor Roger Bouhi, Rome; Isaac Brown Esq.; Mrs. Julia Hussey; the Right Hon. Lord Harrowby, K.G., P.C.M.P. The following papers were then read: 1. "On the Signification and Etymology of the Hebrew noun 'Tirshatha.'" By Richard Cull, F.S.A. The author objects to the Persian origin of the word, as conjectured by Gesenius, Lee, and Fürst, and shows that the term was not applied to Nehemiah by Artaxerxes, who appointed him to be Pecha or governor of the province, but by the Jews, as their chief or head. Nehemiah was governor, but the book is a record, not of his government of the province, but of his acts as the chief and leader of the Jews, and of reorganizing them into a community. The word "Tirshatha" is shown to be a noun derived from a T-conjugation of the verb rosh, to be head, or chief in power and dignity. 2. "On the Olympiads, in connection with the Golden Age of Greece." By W. R. A. Boyle, Esq.—In this paper, after referring to the great battles between Greece and Persia, a rapid sketch was given of the internal divisions and political intrigues between different Grecian States during the Peloponnesian war. One of these arose out of a lifted on exacting the payment by the inmonth of A Lepreum to the Eleians, who material, oction of the Olympic Games, of a talent, as a tribute to the Olympian Jupiter. This the Lepreates refused to pay during the war by reason of the burthens which this imposed upon them, a pretext which the Eleians would not admit. The dispute was referred to the Lacedæmonians; but the Eleians, fearing a hostile decision, were proceeding to enforce payment, when the Lacedæmonians sent a force of a thousand men, who besieged the fort of Phyrcon and garrisoned the city of Lepreum. This was in the second year of the war, just after the Eleians had proclaimed an Olympic truce within their own territory, and were about to proclaim it throughout Greece. Owing to this breach of the established rule, that all military proceedings should at such a time be suspended, the Eleians proceeded no further in proclaiming the Olympic festival which was to follow. This was allowed to drop, and was not held till two years later. It thus happened that one Olympiad extended over six years, instead of four only. This disordered the Olympic reckoning, and thence extended to chronology in general, throwing Sacred History in particular into great confusion. The discovery of the error has furnished a clue by means of which the present erroneous computations may be corrected, the historical accuracy of Holy Scripture may be established, and both profane and Sacred History, from the great Semitic conquest down to the final destruction of Jerusalem by Titus, may be placed upon a firm basis.—3. "On the Sites of Ophir and Taprobane, from Greek and Hindu Authorities." By A. M. Cameron. After showing on what slight and insufficient grounds the Island of Ceylon was taken for the ancient great maritime kingdom of Taprobane, the author proceeded to consider all that was said of it by the ancient Greek and Roman writers, and showed how in every particular, including even the philological argument, from the name, Taprobane was none other than Tipperah or Tepra-van, a kingdom which has now receded inland and is shorn of most of its territories, but which in early times was washed by the ocean, and was a most powerful maritime kingdom, and which, further, there is reason to believe, included the Island of Ceylon as well as Aurea Chersonesus. The origin, seat, and centre of this kingdom, which sent ambassadors to Rome, and which was renowned all over the ancient world was, and still is, at the north-east extremity of the bay of Bengal. In the same way it was shown how extremely inaccurate were the general determinations of Ophir, of which there is so much said in the Scriptures, and which seems to have been a place of the highest commercial importance to the early Hebrew, Phœnician, and doubtless Egyptian, traders and mariners. It was shown how all the marks of Ophir lead also to the same ancient great maritime kingdom which the Hindus called Tapara and Tepra-van and the Greeks Taprobane. These results, with reference to Taprobane and Ophir, both being shown to be one and the same great maritime kingdom, are thus very interesting, and coincide with a shrewd conjecture of the learned Gesenius, who in his notice of Ophir drew attention, among other things, to an ancient place called Uppara, the Greek Hippuros, which, with the usual inaccuracy of ancient maps and the mode of interpreting them, is placed at the southernmost point of the continent of India.—4. "Translation of an Egyptian Hymn to Ammon." By C. W Goodwin, M.A. The hymn, now translated for the first time, was taken from a Papyrus of the 19th Dynasty, in the Museum at Boulaq. The language of the poem is of a very sublime description, abounding with archaisms of language which show the hymn to have been founded upon an older sacred poem. The translation was accompanied by an exegetical comment upon the lesser known words and phrases used by the scribe.

BEST EXPLOSIVES FOR TORPEDOES.

AT first sight nothing seems more simple than to enclose a given charge of gunpowder or other explosive agent in a water-tight envelope, and to explode it at any moderate depth of immersion. Submarine charges were successfully exploded for warlike purposes three hundred years ago. Systems for their application to naval war were developed at the beginning of this century. But it was not until quite recently that investigations, more or less searching, have been made by America, Holland, Austria, France, Germany, Russia, and this country into the principles which determine and govern such explosions. Until within the last few years the modes of igniting submarine charges were crude and uncertain in the extreme, whilst the widest divergence of opinion was entertained by the most intelligent and experienced officers as to the influence exerted upon the destructive results by the interposition of given thicknesses of water between the explosive agent and the bottom of the ship attacked. There were, until quite recently, no exact data for regulating the amount, the nature, the immersion, or the horizontal distance of the charge. Still less, if possible, was known as to the thickness of the enclosing case best adapted to develope the full explosive force of given charges. It has now been ascertained that each varying amount of gunpowder produces its maximum destructive result at an ascertainable depth of immersion and enclosed in a vessel of a particular strength. The lateral distance at which such charges would be destructive when suitably immersed has also been approximately determined. The vertical distance beneath a ship at which explosion may be effected appears, in the case of large charges, to be a matter of little practical consequence. Comparative experiments conducted with small quantities of gunpowder are liable to be vitiated by extraneous circumstances of a minute character, which are apt to escape detection, and need verification by a much wider observation of large explosions than has yet been attempted. Enough, however, has been done to show that gun-cotton, litho-fracteur, dynamite, and such other preparations of nitro-glycerine as may be steadfast in character, have special advantages for naval torpedoes. When exploded by detonation, the thickness and even the tightness of the envelope is of little consequence; whereas the full effect of gunpowder cannot be secured without the employment of very strong and heavy water-tight cases; whilst at least three times the weight of charge is necessary to ensure the same destructive range when gunpowder is the explosive agent.—*Naval Science.*

THE INVENTORS' INSTITUTE,

ESTABLISHED 1st MAY, 1862.

FORTNIGHTLY MEETINGS, DURING SESSION,

HELD AT

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

PAST PRESIDENT—SIR DAVID BREWSTER, K H., LL.D., F.R.S., &c., from the Establishment of the INVENTORS' INSTITUTE till his decease, February, 1868.

PAST PRESIDENT—LORD RICHARD GROSVENOR, M.P., &c., from February, 1868, till May, 1871.

Council:

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APPLICATIONS FOR LETTERS PATENT

*** In this list (Com.) means Invention communicated from abroad.

* Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur-street, Charing Cross.

On April 10th.—1320 to 1336.—S. R. Smyth, C.E. A new oxygen or improved furnace bar.—D. Barker. Manufacture of artificial fuel.—F. E. Duckham. Apparatus for actuating railway breaks.—A. McLeish. Mechanical hammer.—R. Shaw.—Mode of driving the spindles used in machines for spinning, doubling, and winding fibrous materials.—J. W. Powell. Valves for regulating and controlling the supply of liquids.—W. A. H. Thorold. Apparatus or means to be employed in disengaging ships' boats.—N. M. Henderson. Destructive distillation of shale or other oil-yielding minerals, and apparatus therefor.—E. Day and Henry Turner. Applicable to steam boilers.—T. Westhorp. Marine distress signals.—A. M. Clark. Apparatus for registering the flow of water and other liquids (com).—A. M. Clark. Colouring matter or dye (com).—F. Wirth. Process of washing yarns, and apparatus employed therefor (com).—S. T. Stein. Construction of cameras for photographic purposes, and the apparatus connected therewith, together with the process employed therefor (com).—O. Reichenbach. Machinery for tipping railway and other waggons.—R. M. Letchford. Night lights.

On April 12th.—1336 to 1345.—J. Smith. Manufacture of pile fabrics.—J. C. Patrick and J. Tracy. Machinery for the manufacture of envelopes and other similar articles.—G. Weigelin. Apparatus for drying bricks and all kinds of earthenware, for glue, wood, turf, starch, linen, wool, silk, paper, &c.—F. Clark. Turnip-cutters.—J. Raper. Machinery or apparatus for boring brush head stocks.—J. E. Billups and E. P. Lee. Permanent coloured and other photographic pictures and delineations.—W. Smith. Manufacture of peat fuel.—A. J. Beer. Arrangements for letting off birds from traps, specially applicable for use in pigeon shooting.—W. Morris. Process or treatment, and compositions or compounds for the improvement of waterproofing, and preservation from mildew and moths, of silk, wool, cotton, furs, leather, paper, and other articles.—J. Macintosh. Arrangements and appliances for preventing ships and other vessels from sinking, also for raising sunken vessels, and saving persons from drowning.

On April 17th.—1346 to 1352.—H. B. Barlow. Refrigerators (com).—E. Vignier. Aerated beverages, and the apparatus to be employed in their manufacture.—H. A. Bonneville. Ordnance, fire-arms, cartridges, ammunitions, or projectiles, and mode of making up or preparing the same (com.) (Complete specification).—W. H. Crispin. Construction of ships and other vessels, and the arrangement and mode of working the sails used in connection therewith.—R. Dunn. Disconnecting or disengaging apparatus applicable to lowering ships' boats, and other purposes.—T. Critchlow. Equilibrium piston-valves, chiefly designed for hydraulic purposes.—G. Haseltine. Machines for clipping or shearing animals (com). (Complete specification).

On April 15th.—1353 to 1363.—T. P. Hawksley. Construction of specula for surgical and other purposes.—T. P. Hawksley. Construction of stethoscope.—H. Edmunds, jun., J. A. Wood, and D. P. Wright. Lighting and heating by the combustion of hydrocarbon or other volatile oils.—M. Knowles and A. Chalk. Looms for weaving.—W. Brooks. Manufacture of pile fabrics, such as velvet and velveteen (com).—N. Clayton and J. Shuttleworth. Expansion gear of steam engines.—C. Smith. Apparatus for crossing channels, passages, or spaces.—S. W. Clough. Construction and arrangement of fire grates and ranges for cooking and other domestic purposes, and cement for uniting the joints of various parts.—R. Atkin. Construction of ships and other navigable vessels, and propelling, ventilating, and steering the same.—A. Browne. Revolvers (com).—H. Hulsh, M.D. Apparatus for lowering boats at sea.

On April 16th.—1364 to 1383.—V. Petherick and J. W. Rock. Safety valves.—J. McKay and W. MacGeorge. Apparatus for producing blast for smithy fires and other purposes.—B. Giles. Cooking apparatus.—T. Black. Steam engines and apparatus connected therewith.—T. Black. Steam boilers.—W. C. Henderson. Horticultural and other frames to receive glass, and means for affixing glass therein.—A. M. Clark. Preservation of alimentary substances, and apparatus for the same (com.)—W. Foot and H. S. Gregory. Hoops or ribs for railway trucks or vehicles.—G. Johnson and J. Shaw. Steam engines.—J. Booth. Kitchen or cooking ranges.—J. Knowles. Mode of producing the blast in cupolas and furnaces.—J. Foster and J. H. Foster. Construction and arrangement of domestic cooking range or stove applicable to the present constructed kitchen or cottage ranges.—Frank Smith. Construction of railway signal bells.—W. Shaw. Machinery for making or forming and pressing bricks or other plastic forms.—A. P. F. Desmares. Process of, and machinery for, producing relief designs or patterns on woollen fabrics.—T. A. Weston. Machinery or apparatus for raising, lowering, and suspending weights and heavy bodies.—S. H. Hodges and H. F. Wheeler. Machines for trimming, setting, or otherwise operating upon the soles or heels of boots and shoes. (Complete specification.)—J. Henley. Fire-places or grates.—W. Hockley. Composition for treating, impregnating, and coating wood, so as to preserve and render it impervious to water and other fluids.—J. B. Harris. Mode of preparing wire cloth coated with india-rubber, for the

manufacture of washers, piston packing, hose, and such like articles therefrom.—E. L. Berthon, M.A. Apparatus connected with collapsible boats, and also for facilitating the lowering and detaching of the same, and other boats.

On April 17th.—1385 to 1399.—M. W. Ivison, C.E. Sheep dip, which is also applicable to animals other than sheep.—E. Ward. Sewing machines.—M. Benson. Constructing, arranging, and working steam pumping machinery (com).—J. Fowler and G. Mackay. Carriages and waggons with folding heads or coverings.—L. J. Todd. Steam tramway and other locomotives.—J. H. Johnson. Pulleys and pulley blocks (com).—C. Eskrett and H. Searle. Envelopes or "hairs" used in extracting oil from oleaginous seeds and oil-cake making.—J. H. Faulkner and W. Sattor. Measuring or meter taps or valves.—G. Cubitt, C.E. Double furrow ploughs.—H. S. Cederholm and C. Peterson. Ships' logs. (Complete specification.)—R. Coddington. Telegraphic apparatus (com).—T. Nicklin and J. Frost. Ovens for firing pottery-ware, viz., china, earthenware, bricks, and other like purposes.—T. J. Smith. Manufacture of iron and steel (com).—J. T. Griffin. Apparatus or appliances facilitating the cutting of screw threads upon or in tubes, bolts, stems, rods, pins, and nuts (com). J. B. Rickards. Compounds or combinations of ingredients for cleansing and bleaching vegetable fibres, such as jute, hemp, flax, and cottons.

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On April 26th.—1511 to 1527.—T. F. Parsons. Cleaning and polishing tin and other plates.—T. Grimbleby and F. Grimbleby. Machinery for making bricks and other plastic forms.—H. Bridge. Means for assisting riders to mount their horses.—H. Harrison and F. Page. Manufacture of artificial or prepared fuel from anthracite dust or culm, or from other coal dust.—G. Davis. Keels of ships and boats.—R. E. Donovan. Apparatus for stoving or heating tobacco.—G. Haseltine. Railway carriage couplings (com.)—T. E. Yates, H. Yates, and W. H. Kellatt. Wire cards and machinery or apparatus used in the manufacture thereof.—P. Trumble. Manufacture of artificial fuel and fire lighters, and the apparatus connected therewith.—J. Hanson and T. Hunter. Agricultural apparatus for thinning turnips or other roots or plants.—I. A. Timmis. Armour plates or shields.—T. Nixon and P. Quin. Manufacture of sulphate of soda.—C. Barlow. Rifling ordnance (com.)—G. M. Webster. Stove for heating and cooking purposes.—R. Walker. Improved roasting jack and baster.—T. W. Minton. Ovens for firing pottery, glass, and other substances.—A. Tucker. Apparatus for feeding calves and other young animals.

On April 28th.—1528 to 1544.—J. H. Brown. Production of a bituminised coal for manufacturing and domestic purposes.—H. Lyon and E. Robinson. Apparatus for indicating and giving warning of the contents of gasometers, brewers' vats, and other similar receptacles, also useful for giving warning of the rise and fall of water in rivers, weirs, reservoirs, and other fluctuating collections of water.—D. Mannini. Adapting the genet (broom) to the fabrication of canvas, ropes, mats, &c.—J. Oldham, jun. Promoting economy in fuel in steam generators.—W. Thompson. Manufacture of white lead and apparatus therefor.—F. W. Colls.—Manufacture of gas for heating and lighting purposes, and the apparatus employed therefor.—W. P. Savage. Paving.—J. Joyce and Oliver Joyce. Manufacture of fuel.—T. Onion and W. Onion. Domestic fire grates or ranges.—A. Bradbury. Furnaces to be used for raising steam, and other similar purposes.—A. J. Buncher. Manufacture and fixing of composition for coating paper, calico, wood, metal, or other surfaces.—J. Wallace. Apparatus for distilling.—L. R.

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JOURNAL OF THE INVENTORS' INSTITUTE.

JULY 1, 1873.

THE NATIONAL IMPORTANCE OF INVENTORS.

Last month the wail of woe and cry of grief for the great loss industrial and public progress had sustained by the decease of the late Mr. Robert Marsden Latham was our principal topic; this month, with his loss still fresh to us, we are sympathetically led to turn our attention to a subject that appertain to what was his life-long mission, feeling that in so doing we shall be performing work the most satisfactory to him that could possibly be performed. The subject we allude to is the national importance of the inventor, which has most opportunely been brought before us by some passages contained in a work by Mr. William Hoyle, reviewed in another column, entitled "Our National Resources and How they are Wasted." It is true this contains nothing more than a plain statement of facts, but they are so succinctly and pertinently put that we feel it ought to be placed upon record as part of the inventor's case.

In the year 1743 (says Mr. Hoyle) commenced those improvements which have continued to progress, and which have resulted in the present expansion of our manufacturing industries. It was in this year that John Kay, of Bury, invented the fly-shuttle and picking-peg. Before his time the weaver, in order to work his shuttle, had to stretch his arms from side to side of the loom, and if the cloth was more than 36 inches wide it needed two persons to do this, one being unable to reach across the loom. Kay's invention consisted in making the lathe in which the shuttle runs about 18 inches longer, so as to permit of a shuttle-box on each side of the cloth, and then, by means of a string fastened to the picker on each side of the loom, and joined to a handle in the middle, the weaver was enabled to work the shuttle from the centre. A great loss of time was thus avoided, and, where wide cloth had to be woven, one person, by the aid of these improvements, could do the work formerly done by two.

In the year 1769, Robert Kay, the son of the above John Kay, invented the drop-box. This invention consisted in constructing the shuttle-box so that it would rise or fall, and enable the weaver, when using alternately different kinds of weft, to keep his loom at work; whereas, previously, he had to stop his loom to change his shuttles. A great saving of time was in this way effected, and the out-turn of work materially expedited.

In the year 1767, or thereabouts, James Hargreaves, a poor weaver, of Blackburn, conceived the idea of the spinning-jenny. Before his time, one person could only tend one spindle and spin one thread at a time. By means of the jenny, one hand was enabled to work twenty or thirty spindles at once, and thus turn off an immensely greater quantity of work than formerly.

In 1769, Richard Arkwright, of Preston, invented what is generally termed the water-frame, or as it is sometimes called, throstle-frame. This was an application of rollers to the stretching of the yarn, so as to regulate the counts (or thickness of the thread) uniformly, and stretch the yarn with precision, these rollers being so arranged as to work in connection with the spindle.

In the year 1779, Samuel Crompton, of Bolton, combined Hargreave's jenny with Arkwright's rollers, and thus brought out the mule. Through the skill of Mr. Roberts, of Manchester, the mule was made self-acting, the spinner not having now to work or guide the mule, but simply to see to its being kept in order. The value of these accumulated inventions will be seen when it is remembered that, as has been stated, before the invention of Hargreaves, one person could only tend one spindle; at the present time, one man, aided by a grown-up youth and boy, will tend a pair of mules having 1,200 or 1,300 spindles in each, or 2,600 spindles altogether. If these facts be carefully examined, it will be seen that one individual, aided by the machinery of the present day, will produce as much yarn as seven hundred and fifty persons could have done a little over one hundred years ago.

From these improvements there has resulted,—

1st. A large diminution in the cost of yarn, and

2nd. A *considerable increase of wages.*

According to Mr Mann, a spinner in 1760 could only earn from 2s. to 3s. weekly; whereas, now, he can earn from 30s. to 35s weekly. In the time of Crompton, which was after considerable improvements had been made in machinery, the cost of spinning weft, 40 hanks to the pound, was 14s. per pound; for No. 60's 25s. per pound; and for No. 80's 42s. per pound. *Now*, the respective cost of producing will be, 40's 4d.; for 60's 7½d.; and for 80's 1s. per pound.* Such are the advantages resulting from the invention of machinery.

In 1764 the art of calico printing was introduced into Lancashire, and gave a considerable impetus to the cotton industry. A further stimulus was given to it by the discovery and application of chlorine in the process of bleaching, which was introduced from France by James Watt, the inventor of the steam-engine, and applied at the works of his father in law, Mr. MacGregor of Glasgow. Before the application of this discovery, nearly all the cotton goods, in order to be bleached, had to be taken to Holland, where they lay for five or six months in the open air in the fields around Haarlem. At the present time, the bleaching of calicoes can be effected in as many days as it formerly took months, and is also done more effectually.

Mr. Hoyle goes on to show that all these inventions and improvements would not have sufficed to place our national industry in its present proud position but for Watt's improvements in the steam engine, and the inventions of gas-lighting, steam ship propulsion, and railways.

However true all this may appear, and it will, no doubt, seem very commonplace to most inventors, yet the national importance of inventors is not recognized by the Government of this country, which has generally been ready to dispute their claims to remuneration, and now has come boldly forward to say that in future no payment whatever shall be awarded them in respect to any invention the Government may find useful in its service—a proposition that so outrages all our notions of right and justice, that we feel that if the Inventor's Institute will only bestir itself with energy the Government will never dare to make such a proposition one of its principles of action.

* For the information of those who are not conversant with manufacturing phraseology, it may be stated that a hank contains 840 yards, and that when "counts of yarn" are spoken of, the number of hanks it takes to weigh a pound is meant. Thus, by 60's yarn is meant yarn of which it takes 60 hanks, each of 840 yards, to weigh one pound.

Reviews.

Description of Anderson's Feathering Propeller. With Plate. Second Edition, Revised. London: W. Mitchell and Co., 39, Charing Cross. 1873. [Pamphlet].

THE following extracts will afford the reader a general view of this subject:—

This propeller has undergone material improvement in the details of its construction since the former description of it was published, and now comprehends the important advantages mentioned in the following description, viz.:—

The mode of arranging the action of the propeller may be varied to suit any special requirements, but the method preferred for vessels of ordinary build is as represented in the plate, where it is placed under the quarters, one blade working on either side.

The action of the propelling blades upon the water is perfect and continuous, and therefore calculated to obtain the highest rate of speed from the engine power.

The blades are perfectly protected from damage by floating wreck or other objects.

They will act effectively either when deeply immersed or with the lightest draught of water in which a vessel can be made to float.

They may be readily turned fore and aft when not wanted for steaming, so that there is no obstruction to the speed, or to the steering of the vessel, as with the screw.

They may be detached altogether when required without putting the vessel into dock.

The direct action of the blades will give good steerage; and when quick manœuvring is necessary the steering may be assisted by either modifying or wholly reversing the action on either side, thus may be done without stopping or interfering with the engine, and is effected by means under the immediate command of the steersman, whereby the blade on the port side may be feathered to any angle without altering the starboard, or *vice versa*.

In the event of the rudder being damaged the vessel may be steered by means of the propeller alone.

The blades being able to backwater, either separately or together, no reversing gear is required for the engine, and as the latter acts horizontally in a line with the keel, it occupies little space in the vessel.

These remarkable qualities are attained by very simple means, and are alike valuable for ships of war and for merchant vessels, the propeller is also well adapted for the purposes of canal navigation.

Its construction is as follows:—

A transverse shaft is fixed in a suitable frame across the after-part of the vessel, fitted with a crank, to be driven by the engine; the shaft passes through stuffing boxes to the exterior of the vessel, and has at each extremity short crank arms set in opposite directions, and bent outwards to an angle of about 45 degrees, to these crank-arms are attached by ring-collars, vertical guide-rods, the upper portions of which pass through apertures under the quarter, to the interior of the vessel, and to their lower ends the propeller-blades are attached. The upper portions of the guide-rods are flattened and twisted for a portion of their length, so that that part above the twist is at right angles to the part below it.

Guide-swivels, the particular construction of which is described hereafter, are pivoted on either side within the vessel and immediately over the apertures through which the guide-rods are admitted. The flat and twisted portions of the guide-rods pass in succession through the swivels at each revolution of the shaft, and the propeller-blades attached to them are thereby guided and feathered, so that they act with their flat sides to the water for the forward stroke, and pass edgewise through it for the back stroke.

The guide-swivels may be variously formed, but the mode preferred by the inventor is to construct them as rectangular frames, with a pivot at either end. Each of these frames contains two blocks, either of wood or metal, with a space between them sufficient to allow of the passage of the guide-rod, the inner faces of the blocks are rounded so that while bearing upon the guide-rods the latter are nevertheless able to pass easily, and to turn as the twisted portions of them pass through. These blocks are fixed in their frames by bolts passing through slots in the sides of the latter, so that they may be adjusted at any time to their position and bearings. To keep the guide-swivels always in their proper position at right angles to the guide-rods, a tail-piece is attached to their lower sides, having a circular aperture through which the guide-rods also pass, and by which the guide-swivels are prevented from inclining to right or left, when the vessel heels on one side.

For the purpose of changing the direction of the propeller-blades, so that either of them may be made to back water, or act with reduced propelling effect when required, the guide-swivels are, each of them, doubly pivoted in gimbals, carried upon standards attached to a circular plate, fitted into a fixed flange, wherein it may be turned round to the extent of a quarter-of-a-circle, by means of a lever handle, when the guide-swivels are thus shifted round, the guide-rods and propeller-blades attached to them are turned to the same extent in the sockets or ring-collars which attach them to the crank-arms, and present either a diminished surface to the water or their edges only, according to the extent to which the lever-handle is shifted; when it is shifted to the full extent the flat surfaces of the blades face the water during the back stroke, thus creating back water.

The moveable plate, or some other part, should be provided with a bolt or pin for retaining it in the position to which it may be turned.

When it is desired that this action of the propeller-blades shall be controlled from an upper deck, each of the two moveable plates on which the guide-swivels are carried, instead of having a lever handle attached directly to it, should be furnished with cogs on a fourth part of its circumference, actuated by a pinion wheel attached to a perpendicular rod passing upwards through the deck, and fitted at its upper end with a handle or other means of turning it, and with any simple arrangement for keeping it in the position to which it may be moved for changing the direction of the blades. This arrangement is illustrated in the plate.

Another purpose of the arrangements just described is for setting the propeller-blades edgewise when not wanted for steaming.

The general effect of the propelling arrangement is, that at every revolution of the transverse crank shaft the propeller-blades on either side pass in succession through the water, and make, each of them, a forward and back stroke, feathering as they change from the one stroke to the other, one of them being always propelling while the other is returning.

An iron plate is attached vertically under the quarters of the vessel on each side so as to cover the propellers and prevent anything from coming in contact with them.

The application of the propeller to channel passenger vessels is adverted to, and great advantages are stated as obtainable from the adoption of these propellers.

The Gold Yield of Nova-Scotia, 1860-1872. By A. HEATHERINGTON. Compiled from Corrected Official Records.

THIS little pamphlet contains useful practical information on a subject which will be interesting to many of our readers. It is accompanied by tables such as have been published annually since 1865, which show the gradual development of the provincial gold industry; and it is to be hoped that they afford useful data not only for the statistician and political economist, but also for the cautious investor who would naturally seek assurance for the stability of any enterprise in which he proposed embarking in an unembellished statement of results extending over many years. Readers who care not to wade through a long array of figures may take interest in the subjoined summary.

GENERAL RESULTS.—Making allowance for quantities stolen and otherwise not reported—approximately ten per cent. of the whole—the value of the total gold yield from the autumn of 1860 to the close of the year 1872 was £958,000. The traceable and officially recognized yield for the years 1861 to 1872 inclusive, is 215,871 ozs., or £863,484 in value, of which £12,532 (3,133 ozs.) from alluvial washings, and £850,952 (212,738 ozs.) from quartz treated in the mill. The largest declared yield in any one year for the whole province was £109,258 (27,314½ ozs.) for 1867, the largest annual yield of any separate district £57,617 (14,404¼ ozs.) for Waverley in 1865; the largest annual yield of any single mine £34,910 (8,727½ ozs.) from the Tudor mine at Waverley in 1864—not reckoning about 3,000 ozs. known to have been stolen, and the largest bar of gold ever cast was in June 1865, from the same mine, the property of Mr Leopold Buerkner, the weight being 1,200 ozs. and its value £4,800. The largest aggregate amount produced from mines owned by companies, is £220,000 from the Ophir at Renfrew, the Wellington and Palmerston at Sherbrooke, and the American at Waverley. The largest amount produced from a mine owned by one person is £72,000 from the Tudor at Waverley. The largest return in proportion to the workings is £72,000 from the Wellington mine on a 13 inch lode, opened only 180 feet in length and 500 feet in depth.

Promoters of public companies have received about £1,000,000 stg. for claims. The largest price ever paid was £4,500 for two free claims at Waverley of 150 feet each. The largest capital of any mining corporation, proportioned to their holding, was that of the Tipperary and New York Company, who, owning only 300 feet in one and 150 feet in another district, organised for the amount of £50,000.

The provincial Government has received about £50,000 for rents and royalty.

The cost of 2,227,550 days' labour, estimating wages at five shillings a day—which is higher than the average of the first five years—was £556,888.

The cost of 55 mills, the greatest number at any time in operation, may be given as £77,200; allowing £1,600 each for 37 steam, and £1,000 each for eighteen water mills.

The cost of supplies, rated at 5s. for each ton raised, amounted to £56,478.

Incidental expenses, reckoned at ten per cent. on the totals for labour, supplies and machinery, were £69,434.

The total legitimate cost, then, of eleven years declared yield, Government exactions included, was £810,000, leaving a margin of £29,484, reserves comparatively intact, and plant and recoverable tailings worth £75,000.

The production of the several proclaimed districts from the quartz mines alone, continuing developments on lodes now actually worked to a mean depth of 1,000 feet, and confining them to present lateral bounds would, according to the average of declared yields, amount collectively to £27,000,000.

It may be stated that quartz is the chief source of gold in this Province; but several competent authorities, such as Professor B. Silliman and Campbell, incline to the opinion that the auriferous *débris* of this Province have been swept beneath the ocean; but M. M. J. W. Dawson, J. A. Phillips, T.

Sterry Hunt, the late Auguste Michel, and A. R. C. Selwyn, who, in the succession named, have examined and reported on this region, consider that systematic search for alluvial gold might well repay the prospector. At Tangier Harbour a nugget weighing 27 ozs. was found in 1862; and at Middle River, Cape Breton, and Gay's River pieces of gold weighing from 10 grains to 17 dwts. have been washed. At Nine-Mile River, Stewiacke, Indian Path, and Gold River, the alluvions are deep and impregnated with fine gold. From the last mentioned district Dr. How obtained very remarkable results, which are cited in his "Mineralogy of Nova Scotia," and in Dr. Dawson's "Acadian Geology," and were, to a great extent, practically sustained by Mr. Michel's subsequent experiments on the ground. Recent trials on an extended scale at Gay's River gave very satisfactory returns.

Our National Resources; and How they are Wasted. (An Omitted Chapter in Political Economy.) By WILLIAM HOYLE, Author of "An Enquiry into the Causes of the Long Continued Depression in the Cotton Trade," &c., &c. London: Simpkin, Marshall, and Co. Manchester: John Heywood, 141 and 143, Deansgate. (Cheap Edition.)

THIS little book has our highest approbation, as far as it tends to show—as it does very lucidly and strikingly show—that the inventions and improvements in machinery by our countrymen have given to us exceptional facilities for the acquisition of wealth, and that, aided by these various natural advantages, we have developed our trade and commerce in colossal proportions, indeed, we are so pleased with this portion of the work that we have used it in a former part of the present number of this journal. But when the author refers the main cause of bad trade and national waste, to the unwise expenditure of money, and pauperism, summing up all these evils as expressed by the liquor traffic, and advocates its suppression, we think he shows, like most political economists, far more knowledge of industrial pursuits than he does of man, and his many-sided ways and character.

An Essay on the Physiology of the Eye. By SALOM HENRY SALOM. London. Salom and Co., 137, Regent-street, W., 1873.

THE "windows of the mind," as the eyes have been termed, cannot fail to be an interesting topic to every sensible man; hence a readable work on their psysiology deserves the best attention of all friends of science and literature. To say that Mr. Salom has produced a really scientific and readable book on the subject, is to do him no more than justice. The work reviews the subject *ab initio*, setting out with various psychological propositions and apt illustrations of them; thence the author passes to the more practical part of his subject, but we should have to quote too largely to make the matter properly understood. The following extract will, however, afford the reader some idea of the contents of the book:—

"Of the many elegant adaptations of means to ends, offered by the eye to our wonder and admiration, none is more extraordinary nor more exquisitely delicate than the apparatus by which that organ is balanced. Set between six muscles, to which a quantity of highly delicate nerves is supplied, the eye ball can, with great ease, be turned rapidly and accurately in all directions. The manner in which change of ocular direction is effected, is not, however, arbitrary; the *modus operandi* being highly confirmatory of the doctrine that the eye is under the influence of the mechanical force of light-undulations. 'Observations on our own eyes and on those of others, show that the visual axis may be directed in many different directions, but it is only very rarely that the angle can be changed directly, that is, immediately. This change of direction is nearly always effected by zigzag or wave lines. The eye is doubtless always carried directly to the object, but this is the result of practice and habit. . . . The numerous ways in which the zigzag and undulatory movement of the visual axis is performed during the change of direction of the eye, may be demonstrated by looking in the evening, at a well-lighted lantern, and observing the directions of the images which follow the motion of the eyes. It will be plainly evident after looking repeatedly, first at the lantern, then at an object, that the eyes seldom move in a straight line but that, when we do not strive against it, they move in zigzag or undulating lines.' The result is of great importance to our theory. For, from the hypothesis that the eye is in a constant state of oscillation in respondence to undulations whose planes of action are transverse to the direction of the light, it would appear naturally to follow that the eye's traverse must also be effected in a wavy or zigzag manner. That the eye is in a state of motion through the action of light is strongly confirmed by the circumstance that when the eye seeks to change its position it naturally does so as if under the influence of wave action."

This theory of motion produced by the action of light is the central point of the theory Mr. Salom seeks to support.

American Railways as Investments (Chacroft's Investment Tracts). By ROBERT GIFFIN. London. Edward Stanford, Charing Cross.

THE object of this treatise is to put before the British public a favourable view of American railways as investments, and this, we think, the author has succeeded in doing, but whether the opinions expressed in this work are fully, or only partially, justified when all facts concerning these railways are duly weighed and considered, we must leave others to judge for themselves. We can only say that persons seeking investments will do well to consult this work.

Electricity and Magnetism. By FLEEMING JENKIN, F.R.S.S.L. and E., M.I.C.E., Professor of Engineering in the University of Edinburgh. London. Longmans, Green, and Co., Paternoster-row.

THIS work forms one of the excellent series of books that are now being issued by the Messrs. Longman, and called text-books of science, being specially designed "for the general use in schools" and "self-instruction of working men." The particular work before us is one that may be read (as we have read it) with much pleasure and instruction alike to those for whom it is specially designed and others who may be perfectly acquainted with the subject treated in this book, and that as regards the mode and character of the work, it fully bears out and maintains the high standard of merit which may reasonably be expected of the author. We have observed none of those errors which in some of the books issued for a like purpose as those text-books are so often found, and which are written with the definite purpose of simply embodying the principles of the science enumerated in the syllabus of the Science and Art Department of South Kensington, and, for that reason, are but mere fragments of the science sought to be imparted rather than that which it is to be wished should be had. In the introduction of this work the author states "that in England, at the present time, it may almost be said that there are two sciences of electricity and magnetism taught, one that is taught in ordinary text-books, and the other a sort of floating science known more or less perfectly to practical electricians, and expressed in a fragmentary manner in papers by Faraday, Thomson, Maxwell, and others, great in this science. The one is so dissimilar to the other, that, according to the author, it has been quite impossible to give students any sufficient or even approximately sufficient text-book."

These are the principal reasons why the author has departed from the ordinary course usually adopted in works of this kind, and that therefore, instead of beginning the book with simple experiments, he has given a general synthetical view of the science, in which the main phenomena are described, and the terms employed explained. He considers that this general view of the science cannot be made very easy reading, and that if this portion of the book be mastered, the student will readily be able to understand what follows. This seems to us to be a great departure from the usual mode, but it is by no means one that can be looked upon with distrust, for the very name of the author would be a guarantee that his experience has taught him what is necessary in imparting the rules of such a science as here brought before us. The author of this work acknowledges assistance from Sir W. Thomson, Professor J. C. Maxwell, Mr. Culley, and Mr. C. F. Varley, and also to Mr. W. Bottomley, Mr. W. E. Ayrton, and Mr. F. W. King for examining the proofs. In conclusion, we must say that we cordially recommend this work to the attention of our readers, and we doubt not that they will receive instruction as well as pleasant reading by the perusal of its pages. The general get-up of the book reflects great credit upon the publishers.

General Literature.

The Life and Remains of John Clare, the Northamptonshire Peasant Poet. By J. L. CHERRY. With illustrations by Birkett Foster. London: Warne and Co. Northampton: Taylor and Son.

FEW things can be imagined more painful than such a life as that of poor Clare; nor can anything be more discomforting to speculate on than the numbers of such gifted, youths who die and make no sign, born in the lowest walks of life with the promptings of genius in them, but who, through the pressure of adverse circumstances, never accomplish anything, and struggle, and suffer, and die wounded and, it may be, stained by the struggles and temptations so fruitless where no outward help is rendered, and where all has to be done in weakness and blindness by the poor strugglers. There are many such, but John Clare's case is enough at present, as it comes up through the publication of the present volume.

He was the son of a poor labourer, so poor and so weak that he was unable to follow his employment in the fields, and, as his only available resource in his misery, had to subsist on five shillings a week, obtained from the parish. His mother, in this respect, was not more fortunate, as regarded her health, than his father; no wonder, therefore, that the lad himself was weakly, and that being blessed, or cursed, with higher promptings than his position called for, he sought such knowledge as he could pick up, and strove to express himself in prose and verse as a relief to his ardent feeling, and a vent for his struggling thoughts. By this time the world, or those rather who care to know anything about John Clare, have learned how he worked himself into notice, and became, in a certain sense, popular as a poet—how he was patronised by the rich, and, to some extent, spoiled by boon companions—and how ultimately he sank into despair, and became the inmate of a lunatic asylum, where he finished his days after thirty years' detention. It should be stated that during much of that time Clare was quite harmless, and was not strictly confined, so that all things considered the mad-house was better for him than the sane world outside, where his only sure refuge was the workhouse.

Of Clare's poetry much need not be said. It had praise even beyond its merit; still there are many pieces to be found in his writing that describe the face of nature in its many changes with great felicity and truth; and even in the present volume—the contents of which were, for the most part, written in the asylum where he spent so much of his life—there are many touching lines, and some strong lines as well, which show what might have been accomplished by Clare had not poverty and its thousand evil attendants crushed him so ruthlessly. These lines, which refer to his own condition, possess depth and pathos—

I am! yet what I am who cares, or knows?
My friends forsake me like a memory lost.
I am the self-consumer of my woes,
They rise and vanish, an oblivion's host,
Shadows of life, whose very soul is lost,
And yet I am—and live—though I am tossed
Into the nothingness of scorn and noise—
Into the living sea of waking dream,
Where there is neither sense of life, nor joys,
But the huge shipwreck of my own esteem
And all that's dear. Even those I loved the best
Are strange. Nay, they are stranger than the rest.
I long for scenes where man has never trod—
For scenes where woman never smiled or wept—
There to abide with my Creator, God,
And sleep as I in childhood sweetly slept.
Full of high thoughts unborn. So let me lie,
The grass below, above the vaulted sky.

Clare, however, will be chiefly known for his rural poetry, much of which is really good, and for the deep misfortune of his life. Had he been born under different and better influences he might have made himself a name to be remembered even amongst our worthiest; as things were he has left many sweet bits of genuine verse worth turning to in an idle moment. From his earlier works we take the following sonnet:—

THE THRUSH'S NEST.

Within a thick and spreading hawthorn bush
That overhung a molehill, large and round,
I heard, from morn to morn, a merry thrush
Sing hymns to sunrise, while I drank the sound
With joy! and often, an intruding guest,
I watch'd her secret toils from day to day,
How true she warp'd the moss to form her nest,
And modell'd it within with wood and clay.
And by-and-bye, like heathbells gilt with dew,
There lay her shining eggs, as bright as flowers,
Ink-spotted-over shells of green and blue,
And there I witnessed, in the summer hours,
A brood of Nature's minstrels chirp and fly,
Glad as the sunshine and the laughing sky.

It is much to be desired that national education wisely carried out, and an improved condition for our workers in the fields, will in the future give a better chance to such lives as John Clare's, and that in the days that are to come the "genial current" of the soul will not be frozen into despair and madness.

The Lives of the Saints. By the Rev S. BARING-GOULD, M.A. John Hodges, Bedford street, Strand.

THE publication of this book we take to be a lucky speculation. There are a great many saints who, for a long time, have been under a cloud in England—so thoroughly out of fashion, in fact, as to be useless for any purpose whatever. Mr. Baring-Gould, however, is now bringing them before the notice of the public, and if the prices named in the advertisement be obtained, and the twelve volumes sold pretty extensively, a better thing will be made by these dead and gone pious personages than could have been realized any time during the last three hundred years.

Of some of these saints, the information given is so scanty, that one is puzzled why it should enter into any one's head to put it before the public. The life of Saint Ulpian, or Vulpian, occupies less than three lines. We give it verbatim. "Ulpian, or Vulpian, was a youth of Tyre, who was cast into the sea, in a leathern sack, together with a dog, and an asp, which were sewn up in it with him." We cannot help pitying two at least out of the three, but there is not much edification to be received from the story taken as a whole.

Of Saint Walaric we are told that "a boy was sent by his mother with oblations (eulogia) of bread and bottles of wine, and the lad, boy-like, took toll of the food and drink on the way. This St. Walaric detected, and gave the boy a sharp rebuke." It would have been interesting if Mr. Baring-Gould had told us how the delinquent was found out, and what the exact words were the Saint used, or whether, instead of words, he administered the rebuke with his fist or his toe.

There is much more, not quite so good as this, in Mr. Baring-Gould's volumes, which we cannot advise anyone to read unless they have a natural predisposition for nonsense.

The Choice Humorous Works of Mark Twain.—Now first collected. John Camden Hotten.

SAY what we may of the extravagances of this writer, we cannot help being amused by his eccentric drolleries. Sometimes we find passages so gross in their exaggerations so out of truth and nature, so altogether offensive by their want of taste and sense, that we feel disposed to throw the book from us and never look at it again. But we cannot forget how amply this is compensated for by whole pages of most genuine humour, funny nonsense, inimitable eccentricity, that we are compelled to restrain ourselves and turn again to its pages to find food for hearty side-shaking laughter, such as may be looked for in vain elsewhere. This volume contains some of Mr Clemens' best things for after all, we suppose, Mark Twain will have to be known by his true name and we are sorry to add, though in far less proportion, some of his worst. The longer works, "The Innocents Abroad" and the "New Pilgrim's Progress" must by this time be pretty well known to most readers, and though sometimes there may be a disposition to skip, it is difficult to indulge in such a practice lest some of the good things should be missed, from which so much pleasure is derived.

Our traveller in these pages takes quite an utilitarian view of many things, which Europeans regard with great veneration, and in this way the sensibilities of certain readers will be sometimes shocked. On the whole, however, the spirit of the writer is fair and honest enough, and it would be over-nice to take offence if a traveller from a country where there are no antiquities, except such as may have been imported in the course of trade, should laugh at what cannot be grown or manufactured at home.

Some of the short sketches are inimitable. "Journalism in Tennessee" is extravagant, but life in Tennessee is also extravagant. "Baker's Cat" is worth reading again and again. The sagacity of that animal was wonderful. "How I Edited an Agricultural Paper" furnishes many useful hints on the subject of editing in general. The principal thing we have to complain of in this volume is that the publisher had sent out most part of it before in separate shillingsworths. The present volume really contains nothing new, and we know of no reason for its publication beyond the fact that it contains some quaint illustrations, which make the book pleasanter, on the whole, to look at and read. Those who have not seen Mr. Hotten's previous issues of Mark Twain will find this a very pleasant book. We give the following from Mr. Twain's editorial experience as a droll way of putting the ignorance that may sometimes be found in company with ordinary editorial omniscience, especially in a country like America, where it is considered that any man who declares his incompetency for even the most difficult undertaking is unfit for anything.

It must be premised that the editor of an agricultural paper is about to start for his holidays, and the writer takes his post during his absence. After the first number was issued the new editor has several visits. One from an old gentleman of the blandest type, who began thus: "Are you the editor?" I said I was. "Have you ever edited an agricultural paper before?" "No, this is my first attempt." "Very likely; have you had any experience in agriculture practically?" "No, I believe I have not." "Some instinct told me so," said the old gentleman. . . . "Listen, and see if it was you that wrote this—'Turnips should never be pulled, it injures them; it is much better to send a boy up, and let him shake the tree.' Now what do you think of that? for I really suppose you wrote it." "Think of it? Why I think it is good; I think it is sense. I have no doubt that every year millions and millions of bushels of turnips are spoiled in this township alone by being pulled in a half ripe condition, when if they had sent a boy up to shake the tree." . . . This benevolent old gentleman had no sooner taken his departure, when a cadaverous man with a bristly beard "darted within the door, and halted motionless, with finger on lip, and head and body bent in listening attitude. . . . . He turned the key in the door and came elaborately tiptoeing toward me till he was within long reaching distance, when he stopped, and after scanning my face with intense interest for a while drew a folded copy of our paper from his bosom, and said

"There, you wrote that. Read it to me—quick! Relieve me—I suffer." I read as follows, and as the sentences fell from my lips I could see the relief come. I could see the drawn muscles relax, and the anxiety go out of the face, and rest, and peace steal over the features like the merciful moonlight over a desolate landscape:—'The guano is a fine bird, but great care is necessary in rearing it. It should not be imported earlier than June nor later than September. In the winter it should be kept in a warm place where it can hatch out its young.'" There is much more of this, as funny as need be, but the reader must look for it in the volume.

"The Geological Evidences of the Antiquity of Man" By Sir Charles Lyell, Bart, M.A., F.R.S. Published by John Murray, Albemarle-street 1873.

"Light Science for Leisure Hours. Second series, with a Sketch of the Life of Mary Somerville." By Richard A. Proctor, B.A., Camb. Published by Longmans, Green, and Co.

"Sanitary Engineering." By Baldwin Latham, C.E. Published by Spon and Co.

These important works were received too late to enable us to deal with their contents in accordance with their merits.

JUTE PAPER—IMPROVEMENTS WANTED.

The *Dundee Advertiser* was recently, for the first time, printed on paper made from jute fabric, and announced its intention of printing upon jute fibre.

At the same time the above-named journal made the following offer of premiums:—

1. A premium of £50 for the best ream of paper made entirely from jute, suitable for printing this journal, of its average size and weight, and of which the maker will undertake to supply fifty tons at a price not exceeding 4½d. per lb.

2. A premium of £100 for the best ream of paper made entirely of jute, suitable for printing this journal, of its average size and weight, and of which the maker will undertake to supply one hundred tons at 4d. per lb.

The specimen reams to be delivered at the *Dundee Advertiser* Office on or before 1st September, 1873.

Proceedings of Societies.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

JUNE 3RD.—Dr. Birch, President, in the chair. — The following candidates were elected Members: Messrs. J. C. Anderson and A. M. Cameron.—The following papers were read: , "The Legend of Ishtar Descending to Hades," by Dr. H. F. Talbot. In this paper the author translates from the tablets the Goddess's voluntary descent into the Assyrian Inferno. "On the Egyptian Preposition," by M. P. Le Page Renouf. "On a remarkable Babylonian Brick described in the Bible." by Mr. R. Cull.

ZOOLOGICAL SOCIETY.

MAY 20TH.—Dr. E. Hamilton, V.P., in the chair.—Lord A. Russell exhibited specimens of, and made remarks upon, the different varieties of the Carp (*Cyprinus carpio*) cultivated in the German fish-ponds. Mr. Sclater remarked upon the most interesting animals observed in the gardens of some of the Continental Zoological Societies which he had lately visited. Dr. E. Hamilton read a note confirmatory of the extraordinary fecundity of the Chinese Water Deer (*Hydropotes inermis*). Mr. H. E. Dresser exhibited some rare birds from the Ural, amongst which were the Smew (*Mergus albellus*) in down, nestlings of the Rustic Bunting (*Emberiza rustica*), and several specimens of Lilljeborg's *Salicaria magnirostris*, which last he believed to be identical with *Acrocephalus dumetorum* of India. Letters and communications were read by Sir V Brooke, Bart., "On the African Buffaloes," which he considered might be reduced into two species, *Bubalus caffer* and *Bubalus pumilus*, by Mr. St G. Mivart on Lepilemur, Cheirogaleus, and other Lemurine forms, to which were appended remarks on the zoological rank of the Lemuroidea in the natural system,—by Messrs. Sclater and Salvin, on some Venezuelan Birds collected by Mr J. M. Spence, amongst which were examples of two species believed to be new to science, and proposed to be called *Lochmias sororia* and *Crypturus cerviniventris*,—from Mr. R Swinhoe, on the White Stork of Japan, which he referred to a species different from the *Ciconia alba* of Europe, and proposed to call *C Boyciana*,—and by Mr. H. E. Dresser, on certain Oriental species of Eagles (*Aquila*).

METEOROLOGICAL SOCIETY.

MAY 21ST.—Dr. Tripe, President, in the chair.—Mr. H. Colborne, Rev. H. Ffolkes, and Mr. E. E. Glyde were elected Fellows. —The discussion on the question, "Can Uniform Times of Observation be introduced for the Normal Observations?" was resumed. Remarks were made by the President, Messrs. Glaisher, Symons, Sopwith, Bicknell, Scott, Salmon, Strachan, and Dr. Mann as to whether local or Greenwich time should be used, and whether the hours of 9 a.m. and 9 p.m., or 9 a.m., 3 p.m., and 9 p.m should be recommended to observers. The meeting was of opinion that the hours of observation should be 9 a.m. and 9 p.m., and that local time should be adopted. The next question considered was the "Division of the Year for the Calculation of Mean Results." After some discussion, Mr. Sopwith suggested that a Committee should be appointed to draw up a statement of questions on all matters connected with this subject, and that the same be sent to the Fellows of the Society, requesting their reply on all or any of the questions. This suggestion was adopted by the meeting. A paper "On Land and Sea Breezes," by Mr. J. K. Laughton, M.A., was read, in which the author stated that he was of opinion that sufficient attention had not been paid to the subject, and that more careful examination would show that the ordinarily recorded theory is not in accordance with the facts observed. That these prove that sea and land breezes are seldom strong where the land is of that arid nature which gives rise to extreme differences of temperature, and that they frequently are strong where, from the verdant nature of the country, the differences of temperature are trifling, also that the sea-breeze begins out to sea, and comes slowly in, and that the land-breeze comes, in the first instance, distinctly off the land, sometimes as sharp squalls. The necessary conclusion from these observations is that the breezes are winds of propulsion, not of aspiration; and whilst it seems probable that the propelling force, in the case of the sea-breeze, is due to the rapid formation of vapour over the sea, the land-breeze may be the re-action or return of the column of the air which has previously been forced upwards by the sea-breeze. A short paper, by the Rev. F. W. Stow, M A, was then read, giving an account of the observations he had made at Hawsker on the same subject; after which Mr. R. H. Scott gave a description of a double rainbow observed at Kirkwall.

ROYAL SOCIETY.

MAY 15TH.—W. Spottiswoode, Treas and V.P, in the chair. The following papers were read. "On Jeypoorite," by Major W. A. Ross, "On the Periodicity of Rainfall, in connection with the Sun spot Periodicity," by Mr. C. Meldrum; "On the Heating of a Disc by rapid Rotation in Vacuo," by Messrs B. Stewart and P. G. Tait, "Determination of the Number of Electrostatic Units in the Electro-magnetic Unit made in the Physical Laboratory of Glasgow University," by Mr. D. M'Kichan, and "On the Extension of the Numerical Value of π" by Mr. W. Shanks.

May 29th.—The President in the chair. The Croonian Lecture, "On Muscular Irritability after Systemic Death," was delivered by Dr W B. Richardson. The following abstract contains a sufficient summary of the scope and purport of the lecture. After all outward manifestations of life have ceased in animal bodies, there often remains for a longer or shorter period an irritability or life of the muscle—a phenomenon which has been the subject of profound study by anatomists and physiologists for centuries past. The object of the lecture was to show, from a series of original investigations, the conditions under which this irritability exists, how it may be excited, sustained, suspended or destroyed. The points brought forward for demonstration had reference to the effects of cold, of the motor forces (mechanical, calorific, electrical), of the effects of removing or supplying blood, and of the influence of various chemical agents, inorganic and organic, on irritability. In brief, the lecturer showed (a) that cold within certain well-defined limits, suspends but does not destroy irritability; (b) that all the motor forces quicken and destroy it, (c) that the removal of sufficient blood produces extreme irritability in living voluntary muscles, and does not produce immediate cessation of irritability in the muscles after death; (d) that some chemical substances, including several inorganic soluble salts, suspend irritability by maintaining fluidity in muscle, but do not sustain the nervous activity by which muscle is excited to motion, some organic compounds, however, belonging to the nitrites and to the cyanogen series, suspend both muscular irritability and nervous activity so effectually, that for a long time after apparent death from their action the living functions of lower-class animals may return. The physiological evidences adduced were compared with certain phenomena that had been observed, in rare instances, in the human subject after death, and an account was given of the author's various attempts to preserve blood in a condition that fitted it to be employed for the purpose of restoring reduced irritability. In conclusion, Dr. Richardson said, that the next grand development of the medical sciences would be the perfection of research on the subject to which his lecture had been devoted.

GEOLOGICAL SOCIETY.

MAY 14TH.—J. Prestwich, Esq., V.P., in the chair.—The following communications were read "On the Genus Palmocoryne, Duncan and Jenkins, and its Affinities," by Mr. P. M. Duncan; "Notes on Structure in the Chalk of the Yorkshire Wolds," by Mr. J. R. Mortimer; and "On *Platysiagum sclerocephalum* and *Palæospinax priscus*, Egerton," by Sir P. de Malpas Grey-Egerton, Bart.

May 28th.—Professor Ramsay, V.P., in the chair.—Messrs. R. Pictor, T. Devine, and C. S. Seyton, were elected Fellows.—The following communications were read: "The Glaciation of the Northern Part of the Lake-District," by Mr. J. C. Ward, and "Alluvial and Lacustrine Deposits and Alluvial Records of the Upper Indus Basin," by Mr. F. Drew.

CHEMICAL SOCIETY.

MAY 15TH.—Dr. Odling, President, in the chair. Dr. H. S. Armstrong delivered a comprehensive lecture, "On Isomerism," pointing out that the generally received position theory was incompetent to explain many reactions which took place in the formation of metameric and isomeric substances. He suggested that the investigation of the thermal properties of compounds would establish facts which might ultimately enable us to obtain some insight into the matter. A lengthened and animated discussion followed.

ANTHROPOLOGICAL INSTITUTE.

MAY 20TH.—Prof. Busk, President, in the chair. Mr. Hyde Clarke read a paper "On the Egyptian Colony in the Caucasus," in which he pointed out that Herodotus, in his Second Book, had described the community of language, manners, colour, and appearance of the Colchians and Egyptians, which he had attributed to a colony of Sesostris. The Ude, the language of a small and declining population of the Caucasus, conformed to this requirement. On examination of its sounds, primary roots, and structure of words, as well as of its grammatical forms, the points of resemblance were illustrated, particularly with the Bashmuric dialect of Coptic. He examined the nouns, adjectives, pronouns, verbs, and particles, as well as the syntax, and showed the common laws affecting the Coptic and the Ude, and still more the Hieroglyphic and the Ude. Thus the cause of the difference between the Hieroglyphic and the Coptic was shown to be, in many cases, due to original causes, dependent on the comparative grammar of the language, for which a basis was provided. It confirmed the opinion of scholars as to the Coptic being the key for the language of the Hieroglyphics. It was also shown that, both in Caucasia and the Nile regions, there were corresponding members of the earlier Agouv, Abkhass, and other groups; and that the structure of Egyptian grammar is by no means originally due to Semitic, but to much earlier influences. While the great antiquity of Egyptian civilization is thus supported, the question is raised, whether Egyptian may not have exercised a great effect on the sub-Semitic languages.

June 3rd.—Prof. Busk, President, in the chair.—The President exhibited and described a new apparatus for measuring with ease and accuracy the cubic capacity of skulls. Prof. Rolleston, while approving generally the method of Prof. Busk, differed with him as to the nature of the material to be employed; he thought that sand is objectionable, as being subject to hygrometric variation from which rape seed is entirely

free. Prof. Rolleston exhibited a remarkable bronze sword, found in the bed of the Charwell, near Malden, a bronze spear from Speen, near Newbury, and other implements. The President exhibited a series of stone implements from St. Vincent, and Mr. A. W. Franks, through Mr. W. Simpson, exhibited a bow and poisoned arrows lately used by the Modoc Indians, and found in Capt. Jack's stronghold, in the lava beds of Siskiyon County, California. The Rev. Dunbar I. Heath contributed "Notes on a Mural Inscription in large Samaritan Characters, from Gaza," and claimed for it a greater antiquity than the Moabite Stone. Mr. Howorth read a paper, entitled "Strictures on Darwinism, Part II., the Extinction of Types." Prof. Rolleston, Mr Boyd Dawkins, and the President, combated the criticisms of the author.

THE FLINT IMPLEMENTS OF THE DRIFT.

A CROWDED meeting of the Victoria (Philosophical) Institute was held at the house of the Society of Arts recently, the Right Hon. the Earl of Harrowby, K.G., in the chair.

The proceedings commenced by Captain F. Petrie, the Honorary Secretary, announcing that the Institute had carefully invited all leading palæontologists to be present, with a view to a thorough and impartial examination of the subject, and the wish that all who took an interest in it should be present, must have been apparent to those that had seen the notices inserted in all the leading newspapers. He was sorry to say that amongst those who had sent letters of regret were Professor Huxley, Tyndall, and Mr. Pengelly.

The Chairman then called upon Mr. W. D. Michell to read his paper, which was illustrated by a large number of diagrams, and three collections of specimens, including one set produced by Mr. J. Evans. After showing the great importance of the question as affecting the origin and antiquity of man in his relation to the post-glacial epoch, after all the many attempts of proving the existence of man in the Miocene strata, these "chipped flints" of the Drift-type are the only ever, up to the present hour, fully recognised evidences we possess, be they authentic or otherwise. How the flint-flakes, their chips or knives, scrapers, awls of the archæologist, were most of them the common and natural forms in which flint is noticed to break up, fracture and cleave universally, wherever the flint and silicious stones are to be found These pattern forms exactly agreed and were indeed fac-similes in many instances, when made by the commonest methods, such as Blake's stone-crusher and common ways used at Brandon in breaking up hundreds of tons of coarse tabular flint either for building or road purposes. Any one could satisfy himself easily of this at Brandon, &c. The flint-like obsidian as well as other silicious stones naturally cleave into the flake, as mineralogical museums plainly show, so that these minor forms are Nature's own manufacture, as the raw material, often touched up and improved upon by fresh chiselling in a very artistic manner even, and so often are made fit for arrow-heads, &c., by savages down to the present day. The Drift-tools, called Javelin or Spear-head and ovals were remarkable, and often wonderfully "chipped flints," were found in the beds, the finest in the world having been extracted from those at Santon Downham. Mr. Poley's collection at Brandon was unique, yet all these, from whatever bed they may come, present universally the same identical characters, thus forming a type of their own, most clearly defined and marked out; making a chasm and gulf between those of the first and those of the second stone age which it was impossible to bridge over. A gradation—1, size; 2, form showing extent of chipping the surface of the flint boulder, illustrated by diagrams, from the worst up to the best specimen,—was then gone into. From this very important crucial test, Mr. Michell, seeing it exactly corresponded with the chipped surface of thousands of shattered flints in the Drift-beds, and as well from years of experience of the sea-boards of England, was compelled to come to the conclusion that an ape-human or savage human hand never did or could have done this chipping on them. This opinion has been always fully confirmed by every flint-knapper or other Drift-tool hunter of Norfolk and Suffolk he had ever talked over the matter with. Lapidaries and workers in stone and marble also fully agreed with him, as did mineralogists The se natural causes entered into in detail first direct attention to the general mechanical and erosive forces of flint-sand as seen in the denudation of rocks, the power of blown sand to form curious apparently worked stones, together with the tremendous power of the sand-blast, &c The grinding and marble polish given to the shattered flints in these beds, by the combined action of sand and water; the erosive and chipping action of this general combined action were brought clearly out by specimens and diagrams.

The discussion was commenced by Mr. J Evans, who said that he had long differed from Mr. Whitley, who had alluded to the vast mass of flint-flakes in the flint-beds of England, and considered to be natural, and not manufactured Now he (Mr. Evans) held, that when the inhabitants of this island had been dependent for fire solely on the use of flints, and if twenty splinters were made in forming one such flint, we should, in a thousand years have millions upon millions of flint-flakes, made artificially.

Mr. Whitley stated that at St. Acheul he found in the sand-pits 3,000 flint axes, and by calculating the number of flint implements to the population in the neighbourhood, he found there must have been 6,000,000 old flint axes to each inhabitant. Again, at Axminster, where those holding Mr. Evans' views said there must have been a manufactory of flints, he found, in carrying on engineering works, that had there been such a manufactory it must have extended over 600 square miles Could such a manufactory have existed? He found that these flakes in the drift could be traced across Yorkshire to the north of Ireland, and all through to Cork they were, in a geological stratum, generally two feet below the surface of the soil in Belgium. This stratum was six feet thick This conclusively proved that they were not of human origin, but of a geological origin With regard to the flint knives, he found that Blake's stone-crusher—a very intellectual manufacturer—made quite as good knives as were found in the drift With regard to the necklaces at Abbeville, they were found to be formed of globular stones. Now, Professor Rupert Jones discovered that these were simply fossil sponges, some of which had the hole through, and hence they were said to be formed for necklaces by man.

Dr. Carpenter stated that he was not a geologist or palæontologist. He begged to state that scientific men had no desire to go beyond human belief. With regard to the implements brought by Mr. Evans he thought it absurd to say that they were not artificial. He came to that conclusion by the exercise of his common sense.

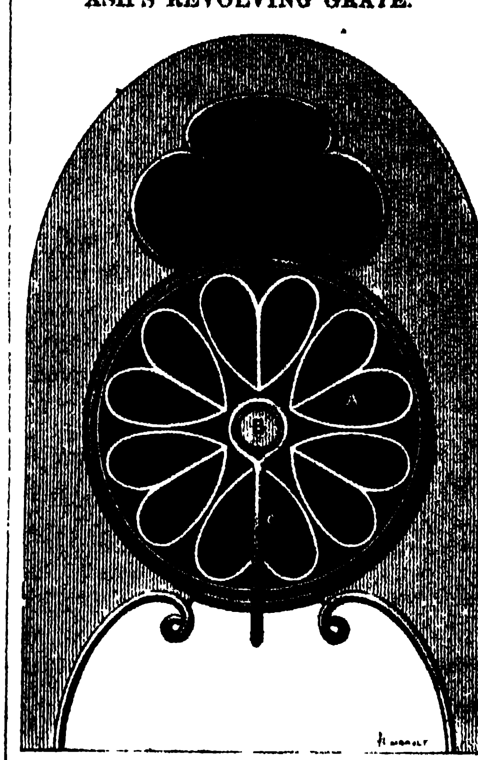
Captain Petrie rose and said that none would deny but that Mr. Evans's were artificial What was held by Mr. Michell was, that the flints of the first palæolithic age were natural, those of the second, like Mr. Evans's, artificial.

Mr Borlase drew attention to the causes of the colouring of the flint implements as being due to the minerals in the soils.

Professor Tennant produced several of the implements formed by Flint Jack. He acknowledged that Mr. Evans's were artificial, but that those on the table, which Mr. Michell held to be natural, were evidently broken by natural percussion.

A vote of thanks having been passed, Lord Harrowby replied, and the meeting separated.

ASH'S REVOLVING GRATE.



THE waste of fuel and heat in ordinary open fire grates has long been a topic on which much discussion has taken place. Many inventions have been promulgated, and many patents been obtained by individuals, for the objects of economizing fuel and obviating the great waste, which, in these days of high-priced coals and fuel, are features of very great importance. The illustration above is for a grate, which, we think, is well deserving of attention, and will, we have every reason to believe, secure, to a great extent, those advantages which are essential in the economizing of fuel and heat. The object of this invention is to so construct and arrange the constituent parts of stoves and fire-grates, especially those of the open kind, so that each feed of fuel may, immediately on being supplied to the stove or grate, which can be effected at the top if that usual mode be preferred, be at once placed at the bottom of the stove or grate, and thus the generation of smoke by the fresh unignited fuel will be prevented, as the products of combustion will be burnt or consumed by the mass of ignited fuel which remains above the fresh feed. To effect this the fire-grate, in circular or nearly circular form, is hung upon a central pin, or axis, upon which the grate may be turned. Suitable openings are provided for the admission of fuel. The grate travels in a circular guide, or against a plate. In the illustration above, the fire-grate travels in the guide formed by the stove, being so made as to receive the fire-grate A. In the illustration, the grate is supported on two axes, one being at the back of the stove (not seen), and the other, marked B, is supported by means of a bracket, C, which proceeds from the back of the stove, and terminates in a bearing for the axis or pin B. It is obvious that a grate may be constructed with only one axis, or pin, as the inventor proposes; and also that the axes may be fixed at the sides of the grate instead of at the back or front. The inventor of the above stove, or grate, is Mr. George Ash, dentist, of 15, Great Marlborough-street, Regent-street.

The Scientific and Literary Review

Is published on the 1st of every Month, and sent by post from the OFFICES, 21, COCKSPUR ST., CHARING CROSS, LONDON, on prepayment of the ANNUAL SUBSCRIPTION OF 6s. 6d.; or, it may be had, by order, from Messrs. KENT AND CO., PATERNOSTER Row, or any Bookseller or Newsagent in the kingdom, *price 6d. per copy.*

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Editor's Office: 21, Cockspur Street, Charing Cross, S.W.

Monthly Notices.

The Fishmongers' Company have, it appears, caught the infection of the Technical Science Advance Movement, and awarded Mr. W. K. Parker fifty pounds for his researches on the anatomy of fish, and a grant of twenty pounds per annum for three years for aiding his researches. Could this great and rich company not do something to promote a Piscatorial Technical College?

Gun-cotton, according to Colonel Younghusband's experiments, can be kept damp and non-explosive for a long time, and used at any time by employing a detonating cap to fire it.

Mr. Bessemer, the retiring president of the Iron and Steel Institute, has founded a gold medal to be awarded annually in recognition of merit in promoting metallurgy, whether by original research or literary labour.

Non-inflammable pocket-handkerchiefs are amongst the latest "notions" of Yankee land. Asbestos has been introduced somewhat successfully into the structure of textile fabrics.

Aluminium has been suggested by Dr. Clement Winkler as suitable for German coinage, which it is just now proposed to reform. He considers Aluminium and silver might replace silver and copper as now used for some of the German pieces of money.

The star shower seen in November, 1872, and at Madras as a comet in December, it is suggested by Professor Klinkerfues, of Gottingen, has some connection with a similar star shower which, according to records amongst Byzantine annals to which he has had his attention directed, occurred A.D. 524. It seems the comet referred to moves in the orbit of Biela's comet, though at a considerable distance. The Professor considers that a comet seen in China in 1162 is the same or has some close connection with Biela's.

The great sea serpent has, it seems, again made his appearance, as we learn from the *Zoologist* that the Rev. John Macrae (of Glenelg, Inverness-shire), and the Rev. David Twopenny (of Stockbury, Kent), saw an animal, believed by them to be that called the Norwegian sea-serpent, off the western coast of Scotland, while on an excursion from Glenelg to Lochowen, in August, 1872. They give sketches of what they saw; and the editor expresses his conviction that there does exist a large marine creature, unknown to naturalists, which has given rise to the belief in a sea-serpent.

Aniline, according to M. Langorrois, is capable of arresting the putrefaction of animal matters, even when exposed at a high temperature to atmospheric influences.

The cultivation of mushrooms in railway arches has been recently suggested by the Rev. W. J. Berkeley—our great authority on cryptogamic botany.

We extract the following from the *Athenæum*:—A new gas-burner, known as Wallace's burner, has been found, by Mr. G. J. Warner, to be peculiarly adapted for producing sensitive flames. The gas flame issuing from such a burner is singularly sensitive to sound, especially to high notes.

For upwards of forty years the ipecacuanha plant has been cultivated in the Royal Botanic Gardens, Edinburgh; but it is only of late that the plant has been propagated. The continued destruction of the ipecacuanha plant in Brazil, and the risk of scarcity in the supply of this valuable remedy for dysentery in India, called attention to the desirableness of introducing its cultivation into our Indian possessions. Great numbers of the plant have, therefore, been sent from Edinburgh, and extensively distributed in India. A paper on this subject, by Professor J. H. Balfour, will be found in the last part of the "Transactions of the Royal Society of Edinburgh."

M. Desains was elected, by the Académie des Sciences, at the *séance* of the 12th of May, a member of the Section of Physics, in the place of M. Babinet, deceased.

The death is announced of Christopher Hansteen, for many years Professor of Astronomy and Applied Mathematics at the University of Christiania, Norway, and Director of the Observatory there. He made many valuable contributions to our knowledge of terrestrial magnetism, and was sent by his Government on an expedition into Siberia, with that object, in the year 1828; to him we principally owe the establishment of 11·1 years as the length of the periodicity of the magnetic declination, a period which also agrees with that of the maximum and minimum frequency of the solar spots, and appears to be connected with that of many other terrestrial phenomena. Prof. Hansteen died on the 15th of April last, at the advanced age of upwards of 88.

L'Institut for the 7th of May gives the important portions of a paper, by M. Chautard, "on the Influence of Rays of Various Colours in the Spectrum of Chlorophyl." Amongst other matters of interest, he explains the persistence of green in the leaves of some plants late in the autumn to be due to the presence of resinous or fatty matter in the plant. He finds that chlorophyl dissolved in fixed oils is not sensibly altered after many days' exposure to full sunshine, dissolved in water it changes rapidly.

M. Czermak, of Leipzig, communicated, in December last, to the Academy of Sciences of Vienna, some curious experiments on Hypnotism—or, as it is often called, Braidism—as observed upon man, and, more especially, on animals. He shows that the causes producing sleep and catalepsy, which are the most efficacious, are those which secure the fixedness of attention and of the eyes. The experiments are an extension of the celebrated *Experimentum mirabile*, described by Athanasius Kircher in 1646. It appears that by very simple manipulation fowls and other birds may readily be thrown into a cataleptic state. Czermak's paper, published in Pfluger's *Archiv*, is an interesting contribution to our knowledge of this obscure condition of our nervous system.

It is worthy of note that Mr. E. H. Hoskins, of Lowell, Massachusetts, U.S., has showed by experiment, that collodion may be usefully employed for the preservation of charred paper. Many papers charred in the great fire of Chicago—bank-notes, &c.—were treated with collodion, which forms a thin transparent film, and dries in a few minutes. The printing or writing can be read through this film. We give this on the authority of the *Scientific American*.

It is reported that a new hydro-carbon has been obtained from crude anthracene, a result of coal-tar distillation. The name of "Phenanthrene" has been given to it.

Alorcin acid is the name given to a new acid obtained from aloes by Herr P. Weselsky described by him in the *Annalen der Chemie*.

The use of platinum into alloys of nickel and German silver has been patented by M. Helonis, of Paris, and such alloys are, it appears, thereby rendered little liable to oxydation, and a brilliant colour is given to aluminium bronze by the introduction of a small quantity of platinum

It seems that the old story of "bread with gin in it" is not without foundation according to Mr. Thomas Bolas, who writes in the *Chemical News* stating that forty 2lb. loaves contain about the same amount of alcohol as a bottle of port

Mr. G. J. Symons has, says the *Athenæum*, just issued his British Rainfall for 1872 The most remarkable rainfall of the year appears to have taken place on July 6th—7th. On the 6th, at five stations in Cornwall and Devonshire, more than 4 inches of rain fell; and on the 7th a similar quantity was registered in Wales: more than 2 inches being registered at all the stations in Great Britain "It is almost impossible to realize the bulk or weight of water thus precipitated. It is considerably within the truth if we take the area as 125 miles from E. to W., and 200 miles from N. to S., or 25,000 square miles, and assign to it a mean rainfall of 2 inches; yet even that would give some 750,000,000,000 gallons" While on this subject, it is worthy of notice that Mr. C. Meldrum, of the Meteorological Observatory, Mauritius, in a paper read before the Royal Society, on the 15th of May, appears to show a real periodicity of rainfall in connection with sun-spot periodicity

"Science Gossip" in the same journal states:—Professor Tyndall by his thirty-five lectures in America returned 23,100 dols. The surplus above expenses, amounting to upwards of 13,000 dollars, was conveyed by an article of trust to the charge of a Committee, consisting of Prof. Joseph Henry, General Hector Tyndall, and Professor E. L. Youmans, who are authorized to expend the interest in aid of students who devote themselves to original research. Professor Tyndall also gave 250 dollars to the Yale Scientific Club for a like purpose.

Professor Dove, of Berlin, has communicated to the Royal Prussian Academy of Sciences some observations on the rainfall in the various parts of the Spanish Peninsula, with comparative observations from the northern coast of Africa and the interior of Algiers These observations he published in a recent number of the *Monatsbericht* of the Academy

Kirchman recommends for gilding iron the employment of sodium amalgam. This leaves a coating of quicksilver, upon which chloride of gold is poured, and the mercury volatized by heat.

A new work, by Professor Alberto Errera, will shortly be brought out by E. Loescher, entitled "Industria e Marina dell' Adriatico Superiore," or the naval industries of Italy as represented at the Exhibition of Vienna.

Dr. G. Bellucci, in the *Gazzetta Chimica Italiana*, appears to have cleared up a question which has been under discussion since, in 1856, Dr. Scoutetten stated that the oxygen evolved from plants in sunshine is ozone. Dr. Bellucci gives, in his monogram, a *résumé* of all that has been done, and records his own careful experiments, which show that ozone is not given off by plants in sunshine.

Pig-iron rich in silicon can, according to the researches of M. S. Jordan, be produced by a furnace worked slowly at a very high temperature, provided the ingredients of the charge be rich in silica and alumina.

Baron Liebig is to have a monument, a committee having been formed in Munich to promote it.

Gardeners have long affirmed that the moon's rays give great activity to the growth of mushrooms. M. Charbonnier, of Paris, states that he has observed in his aquaria a very remarkable growth of cryptogamus vegetation under the influence of the light of the full moon

Dr. Percy has written to the *Times* stating that more than twenty years since, he manufactured an alloy with manganese, which so much resembled German silver that it was sold as such to electro-platers without their detecting any difference.

The cultivation of science spreads steadily. A scientific society has recently been established at Buenos Ayres, Mr. A. Luis Huergo for its first president. According to their programme, the members have arranged for carrying out several branches of original research

Mr Sortais has devised an electrical apparatus, to be placed in the holds of ships, for the purpose of giving warning in case of leakage. A current is established by entrance of water, and a communication is thus set in operation, which gives notice to the officers on deck.

The *Athenæum* states that a magnet of extraordinary carrying power has been constructed by the well-known French physicist, M. Jamin. Whilst artificial magnets have not hitherto been made to carry more than four or five times their own weight, this magnet is able to sustain upwards of twenty-two times its weight. It is constructed of a great number of thin well-magnetized plates, instead of the thick plates generally employed.

It is just now a matter of interest to know that, in 1872, 1,900,000 tons of iron were made in the United States; 923,527 tons were produced in Pennsylvania

It is stated by M Austin that glycerin mixed with the water in the boilers of steam-engines prevents the deposition of the lime salts, and, consequently protects the boiler from incrustation. About one pound of glycerin to every 300 or 400 lbs. of coal burnt is said to be sufficient for this purpose. The report on Boiler Incrustation, in the *Journal* of the Franklin Institute for March, does not mention this; but the reporters confess "that they are groping in the dark, and cannot conceal from themselves what must be apparent to others, that the question is yet an open one."

It is found by Dr. Walz that glacial acetic acid forms an excellent solvent for iodine, certainly not inferior to alcohol.

THE VICTORIA INSTITUTE, OR PHILOSOPHICAL SOCIETY OF GREAT BRITAIN.—We have received the annual address and report of the year, &c., and have to reserve them for future publication.

The Inventors' Institute.

AT the meeting on Thursday, 12th June, 1873, Hume Williams, Esq., barrister-at-law, Vice-Chairman of the Council, in the chair, Mr. Williams commenced the proceedings by reading a letter from Sir Antonio Brady, the Chairman of the Council, explaining that the reason of his non-attendance was urgent important engagements, and expressing his sense of the great national importance of the subject proposed to be brought under the consideration of the meeting.

After some remarks by the Chairman with reference to the difference between bogs properly so called, and fens, the first being by no means unhealthy, possessing, so to speak, antiseptic and preservative qualities, whilst malaria was a concomitant of the latter, and generating agues, fevers, &c., he called upon Mr. Love to read his paper.

Bogs (said Mr Love), from top to bottom vary in density, when dried, each strata varying in gravity from one-sixth that of water to equality and sometimes more. The colour of the cut peat when dry varies in proportion to the density, that on the top being a light drab, each strata getting darker and denser till it becomes at the bottom almost as black and dense as coal. This is more especially the case when the bogs are of great depth, such as the bog of Allen, in Ireland, which in some parts reaches fifty feet, its average being calculated at about fifteen feet, and the area of this and those of a similar nature above 1½ million acres; and of mountain bogs there are about 1¼ million acres, besides these, there are about a quarter of a million acres of low fen or marshes, producing good meadow and pasture, which should be left out of our calculation, as it would be unwise to make stagnant lakes of them, for the sake of the fuel they would produce. Bogs have been divided by scientific men into high and low; and by practical men into bogs or mosses, and fens or marshes, the former being well represented by the bog of Allen, in Ireland, and Chatmoss, in Lancashire, and the latter by the fens of the eastern division of this country and the marshes of Kent and Sussex. Of these vegetable earths of all sorts we have over five million acres in the three kingdoms, of which at least four million acres would be benefited immensely for agricultural purposes, by the removal of the vegetable material, the subsoil in general when drained and cultivated soon becoming highly productive of all kinds of cereals, green crops, and grass.

High bogs or mosses have heretofore been difficult to reclaim profitably, being composed of vegetable matter saturated with tanin and humic acid, which prevents decay and the development of food fit for plants of that high class used by animals; the expense of drainage being great, the interest of the money expended therein has swamped the profits, owing to its taking some years before the rains wash out these acids, and the combustion of these inert fibres reduces them to fertile earth.

Another cause is, that as the water is drained out the bog collapses, and there not being depth enough, freed from these acids; supplies of these are raised by the capillary action of its fibrous nature, and arrests the advance of combustion or decay, so that the great necessity is a cheap means of under drainage, that can be repeated after each collapse, until a fertile soil is formed by this decay to a sufficient depth and density for profitable farming.

Fens, or marshes, are in low situations on the banks of rivers subject to their floods, producing reeds and aquatic grasses which contain but little tanin, and when laid dry by drainage rapidly decomposes into rich black earth, forming the finest pastures and productive land; by excavating these for fuel most valuable land would be converted

into wastes of stagnant water, a process which is now going on in Germany, France, and some other countries, but at present not desirable in this country, and will not be for a long period of time.

Bogs, or mosses, are only productive of heaths, mosses, and lichens, with occasional plants of bog myrtle, birch, and stunted firs; even after drainage it takes a great number of years for the fibrous, soft, spongy material of the surface to decompose into soil dense enough to carry grass and agricultural crops, but as the under-strata is convertible into good land, the conversion of the upper incumbent bog into fuel is very desirable, seeing that it is one means of increasing the inhabitable and productive area of our country. Bog, as it is dug or excavated, contains from 75 to 90 per cent. of water, and, as a general rule, the more water it contains the less it shrinks in drying, the spongy surface bog not shrinking more than 25 per cent., while the soapy, solid bottom shrinks 80 per cent. In practice air-dried peat contains from 15 to 25 per cent. of water, and coal, as sold by merchants, from 12 to 20 per cent.

The art of pounding and treading decomposed bog earth into a homogeneous mass, and then spreading it out into a thin layer, and cutting it at right angles into pieces, or shaping it into balls by hand, and laying it out to dry, has been in practice for ages, but it was not until the superior action of machinery was brought to bear upon the living and growing fibrous spongy bog that it could be reduced into that homogeneous state necessary to make it shrink into dense fuel. This has, with more or less success, been done in Germany and Bavaria, where the price of coal being higher and labour much lower than with us, gives the peat fuel manufacturers a greater chance of success. In 1837 machinery was introduced both into Scotland and Ireland for pulping bog into a homogeneous mass that dried into fuel of great density, and estimated at two-thirds the value of coal, weight for weight, but the labour of carrying 80 per cent. of water to the machine and out again on to the drying ground, to be carried off on the wings of the wind, has hitherto completely swamped its commercial success. It is not to be contended that a ton of dense peat will give out any more heat than a ton of the same bog cut into peat, that when dry is four or five times the bulk of the dense peat; but this enormous bulk made it unwieldly and expensive to use, as well as almost impractical to carry from the place of production to that of consumption, therefore, before peat can be carried by rail, or any other means, to compete with coal, it must be got sufficiently dense to allow of from eight to ten tons being put into a truck 14 × 7 × 6 feet = 588 cubic feet, this is amply attained by a density of 45 lbs. per cubic foot, which is equal to that of hard wood; we have before us in these samples proof that the density required can easily be obtained.

The difficulty of drying ground, the immense labour of carrying a hundred tons of material to the machine, then away from it and laying out to dry, cannot be estimated at less than 6d. per ton, or 50s. for the resultant twenty tons of fuel. This half-crown per ton I will save by my contrivance, the great novelty of which is that my machine cuts through the surface of the bog, excavating a tract for itself, pressing the surplus water out, and cutting the material into thin slices, which are beat and rubbed into homogeneous pulp, then rammed down into a compact piece the width of the machine, cut into the sized pieces desired, and laid down upon the same place to dry that the material was raised from.

Gentlemen who have had experience in the manufacture of dense peat, either by hand or machine, are aware that if (while in a state of pulp) laid upon a smooth damp surface the peats will adhere to it, and require cutting or other force to separate them from the ground. This was one of the greatest difficulties to be got over in my system, and now accomplished by using a corrugated sole, or slide, to the machine, which leaves the surface of the drying ground also corrugated, the peats resting on the ridges allows the air to circulate through the valleys, or furrows, under the wet peats; they rapidly dry, as rapidly shrink, in all directions, leaving spaces between them increasing in width. Another difficulty has been the tough fibrous material of the upper half-depth of these bogs gathering in the pulping apparatus absorbing power, and often blocking the machine. This I have got over by the use of sharp knives that cut the large slice excavated into very thin slices, reducing the fibres into very short lengths before being delivered to the pulping apparatus.

My machine is upon quite a new principle, as well as novel in many of its details, suggested during years of study and experience of the great labour of handling such an immense weight of water, carrying it to and from the machine, the immense area of drying ground required, all creating heavy expenses, at last the idea came of hauling, the machine laid flat on the bog excavating a slice of such thickness as to produce pulp, to cover the ground passed over, such a thickness as could be dried into the most dense fuel. This, with some of its most important details, I have just patented, and wish to give you information as to its economy of labour and power of production, the whole being worked by an ordinary traction engine with steam cultivating apparatus.

On the middle of the machine is a large rigger, or riggers round which the hauling rope is passed, one end being fast to the steam engine, or windlass, and the other end attached to the winding drum of the windlass. This is the working rope, that is, the machine, when hauled by it towards the engine, operates, the engine, by this means, has double hauling power, and the friction of the ropes gives motion to the rigger, which drives all the works of the machine.

Another rope, named the idle rope, is attached to, what we will call, the back end of the machine. This rope is carried as far up into the bog as is most economical in practice—say ¾ of a mile, where it is passed round the pulley or rigger of a Howard's or any other good self-acting anchor, and then attached to the drum of a windlass, the action of which hauls the machine up into the bog to the anchor, then the windlass being reversed, the working rope hauls the machine toward the windlass and engine, which are on the sound ground outside the bog. The machine, while operating, travels at half the speed of the rope, the rope having to bear both the strain required to haul the machine and that required to drive the machinery used to manufacture the slice of bog into peat. The working drum will be geared so as to have great power therefore to coil slowly, say at the rate of one mile per hour. The idle drum having merely to haul the machine over the bog, a very high speed and lighter rope will be used, travelling, say, at six miles per hour. The width of machine I propose to use is four feet nine inches, which, allowing for loss in reversing, is about ½ an acre for every lineal mile operated upon. In nine hours we will get over eight miles, absorbing eight hours in working, and 1¼ in running up the bog idle, being 9¼ hours a day, covering four acres with 2½ inches thick, which, when dry, will yield 20 tons per inch deep of pulp, or 50 tons of dry fuel per acre, the four acres yielding 200 tons of dry fuel.

From the middle of March to the end of August, 120 days' work ought to be obtained, producing 24,000 tons of fuel.

The same arrangement carries into action my draining engine, which I have also patented.

This engine also goes over a mile in one and one-sixth hours, doing eight miles of drain from four to five feet deep per day, leaving a clean cut bore or tunnel, six inches in diameter, at £3 per mile, or 10s. per acre drained, sixteen and a half yards apart. After this drainage has caused the bog to collapse so that these drains are within two feet of the surface. The second drainage should take place. Then during the following winter months, the peat manufacturing machine should be used without the pressing, stamping, and peat cutting parts, the putting aside of which will enable a greater depth to be operated upon, enough to give from four to five inches of finely comminuted bog, which will give up freely to the rainfall. The sterilizing acids, which, with the rainfall, will pass away through the drains, leaving earth as dense as if it had been 20 years under ordinary cultivation, and fit to make rough pasture. Of this work at least four acres a day will be done at £3 an acre. 250 days' work per annum ought to be got out of each set of machines, engines, and tackle, which will cost less than £2,000, on which for tear, wear, and renewal

	£	s.	d.
1 charge at 25 per cent. per annum	500	0	0
250 days' peat fuel, say 1½ tons a day, at 7s. 6d. per ton .	140	12	6
Oil, grease, cotton, waste, &c., at 5s a day . . .	62	10	0
2 machine men at 6s., and engineer at 8s.	250	0	0
Man fetching water for engine 3s., and 3 lever-porter boys at 1s. 8d. a day . . .	100	0	0
Annual expense of Plant	1,053	2	6
24,000 tons of peat fuel dried, hauled, stacked, & thatched at 2s. 3d. per ton	2,700	0	0
Manager and clerks, &c. .	800	0	0
Landlords' royalty of 6d., and patentees of 3d. per ton of dry fuel—24,000 at 9d	900	0	0
Patentees royalty of 10s. per mile of drain on 520 miles	260	0	0
Patentees royalty of 10s. per acre on 260 acres . .	130	0	0
Annual expense of Drying and Storing .	1,790	0	0
Total	5,843	2	6
£5,000 capital at 40 per cent. dividend, £2,000; and surplus, £496 17s. 6d. .	2,496	17	6
Total Disbursements	8,340	0	0

Returns.

120 days producing 24,000 tons peat fuel at 5s. a ton	£6,000	0	0			
65 days draining at 8 miles—520 miles at 60s . .	1,560	0	0			
65 days cultivation at 4 acres—260 acres at 60s.	780	0	0			
Total returns .				8,340	0	0

Looking at this important subject from a national point of view, with our eye fixed on the fact that the subsoil of bogs generally forms first-rate land after the bog stuff has been carried all away, and the sun and air allowed free action upon it; in fact, after drainage, and the application of improved cultivation, these soils generally attain the highest type of fertility. Such being the case, all the shallowest bogs ought to be

operated upon first, for the manufacture of fuel, for inasmuch as two or three slices of about four inches thick will be worked off per annum, nearly a foot will be annually worked off, by which means, in a few years, each succeeding year we would have considerable numbers of fertile farms added to our country.

The deep bogs, many of which are still undrained and in a state of growth, and yearly increasing in depth by the prostration of each year's produce of rough sour vegetation, such bogs when drained 10½ yards apart and four or five feet deep, immediately change from a state of increasing depth to that of decay and speedy collapse, sometimes at first sinking at the rate of a foot per annum, becoming denser every year until the whole becomes as dense as the bottom, which makes dense fuel, merely by cutting into thin peats and drying, which my machine does, by dispensing with the pressing and pulping parts; the slice or slices excavated being cut into thin strips, then turned on edge, the better position for drying, and then cut into the lengths desired.

These bogs, when once started growing grass, and re-drained, as often as the sinking and decomposition lowers the surface to within two feet of the drains, and dressings of lime or marl, with cattle and sheep grazed on them, kept increasing both in size and fatness, by the economical use of corn and cake; by such management, these large areas of barren wastes will fast be converted, first into useful grounds for breeding stock and healthy game, gradually becoming richer and stronger, till they become like the feeding marshes of Essex and Kent, feeding large herds of cattle and flocks of sheep, while the climate would be vastly improved by the extraordinary change from its state of being swamped with stagnant water, remaining to be evaporated during the spring and summer months, loading the air with oppressive humidity and pestilential vapour, spreading mildew over the wheat fields of the surrounding district. Effectual drainage allows the rains to percolate through the earth into the drains, purifying and fertilizing the ground, redeeming the air from polution, leaving it in its pristine purity to give health and vigour to the sweet pastures and green herbage covering its vast expanse, increasing the health, wealth, and blooming beauty of our lovely country.

When Mr. Love had concluding the reading of his paper,

The CHAIRMAN invited discussion, and in doing so remarked that the present paper was directed wholly or chiefly to the mechanical means of removing the bog so that the substance removed might be air-dried for fuel, and the locality of the bog by drainage rendered fit for farming purposes, Mr. Love's proposition, as far as he understood it, being to use an ingenious development of Fowler's steam plough. He considered that the subject of bog utilisation should take a wider scope, and therefore he would specially invite to join in the discussion several gentlemen he saw before him in the room, who to his knowledge took considerable interest in the subject of treating bog and peat by chemical and mechanical processes in order to obtain valuable products therefrom, so that the meeting might have the benefit of their experience. The subject of utilisation of bog and peat earth was one of very great practical importance to this country now that the cost of coal fuel was at such a high rate, and he could himself testify that the reclamation of bog land was usually a costly affair. He had known members of his own family make attempts in that direction which proved anything but profitable to them.

Mr. FOTHERGILL, C.E., stated that he had some plans for the utilisation of peat, a subject he had given much attention to, but at the present time he was suffering from the effects of a cold which so affected his speaking powers that he would rather, if the Institute could so arrange it, reserve his observations for some future time. He showed specimens of dense and compact pieces of peat fit for fuel, and having the appearance of cannel coal or jet. He stated that he had made peat charcoal, and obtained various other products from bog earth, all which had been effected by machinery and processes of a very economical character. He considered peat fuel far superior to coal for iron manufacture and steam raising purposes.

Mr. FRANCIS FULLER wished to know if the peat shown by Mr. Love was compressed. Mr Love stated it was not compressed, but simply air-dried. He would also ask, did the use of the peat charcoal improve the iron? This was answered in the affirmative.

Mr. RUMBLE, C E, referred to experiments made on board the Tyne boat for Mr. Penn, and remarked that although very favourable results had been obtained, yet they would have been far greater if the firegrate had been adapted for the purpose of burning peat fuel He had not the slightest doubt that both compressed and uncompressed peat could be used for practical purposes with very great advantage.

Mr. FRED RANSOME, C E., thought Mr. Love's invention one that merited the attention of all practical men. If peat charcoal were so valuable in iron manufacture as had been stated, and he cast no doubt upon it, the subject ought to be thoroughly discussed by the Inventors' Institute.

Mr. A. J. MURRAY said he quite concurred in what Mr Ransome had stated, and he was prepared to move that the question be adjourned for further discussion on another evening.

Mr. E W. COULTHARD, C E, said that Mr. Love's paper, and the statements of those who had taken part in the discussion, had shown the importance of this subject, he would, therefore, move that the council be requested to adjourn the discussion

Mr F. H. VARLEY seconded this motion, which was carried unanimously.

The CHAIRMAN then moved a vote of thanks to Mr. Love for his able and interesting paper read before them that evening.

Mr C. G. CARTTAR seconded this motion, which was carried unanimously

Mr LOVE having briefly returned thanks, the meeting, by a vote of thanks to the chairman, was brought to a close

The council have not yet been able to arrange any day for the adjourned meeting

At the council meeting (special) held the same day (12th of June,) previously to the above meeting, the minutes of two previous meetings were read and confirmed as correctly entered.

A letter from Sir A Brady was read accounting for his absence.

The following resolutions were then passed (on the motion of Mr. A. J. Murray, seconded by Mr. Coulthard), "That Sir Antonio Brady be re-elected chairman of the council," and (on the motion of Mr Mr. Ransome, seconded by Mr. Carttar,) "That Mr. Hume Williams be elected vice-chairman of the council for the ensuing year;" also (on the motion of Mr. Carttar, seconded by Mr. A. J. Murray,) "That Mr. Varley be elected chairman of the ordinary council for the ensuing year;" also (on the motion of Mr. F. H. Varley, seconded by E. C. Coulthard, "That notices as to the council meetings, and other meetings of the Institute published in the journal of the Inventors' Institute (SCIENTIFIC and LITERARY REVIEW) shall be good and sufficient notice, and when transmitted by post to the members shall be deemed circulars within the rules."

A discussion then ensued as to the treasurership of the institute, but as the time for opening the ordinary meeting was nearly up, and no decision had been arrived at, it was agreed that until further orders, the present Treasury or Finance Committee, viz, Capt. Selwyn, Messrs. H. Williams, C. G. Carttar, Coulthard, and Campin (the secretary), should remain in office.

Mr. HUME WILLIAMS, in the course of the proceedings, solicited the attention of the council to the reported action of the Government with regard to the remuneration of inventors. He was informed that it had been decided that no payment should be made for the use of any invention by the Government of this country. This seemed to him a monstrous proposition, and in order that something effectual might be done in this matter, he had placed himself in communication with Mr. Thomas Webster, Q.C., Mr. Aston, and other authorities in Patent Law questions, and he hoped the council would appoint an early day for a conference on the subject.

Messrs. Steinhoff, Vickers, Collier, Cadett, and Vacherot, having been admitted members, were ordered to be entered in the list of members of the Inventors' Institute.

SANITARY AND EDUCATIONAL EXHIBITION.

In connection with the Social Science Congress, to be held at Norwich, from the 1st to the 8th of October next, there will be an exhibition of educational, sanitary, and domestic appliances, based on the experiment which proved so successful at Leeds, in 1871 The large and spacious Drill Hall has been placed at the service of the Social Science Association, (with the sanction of the Government,) by the commanding officer. The object of the exhibition is to bring under the notice of the public generally, and particularly those who are interested in social, sanitary, and educational questions, the latest scientific appliances for improving the public health and promoting education. Among these may be mentioned. — All matters relating to house construction, connected with which are building materials, light, warming, ventilation, and interior ornamentation, flues, fire-places, stoves, boilers, furnaces, gas apparatus; cisterns, baths, piping, filters, fountains lavatories, and all things connected with the supply and use of water; drain pipes, tubes, sinks, traps, troughs, closets, urinals, filters, and all plans, diagrams, sections, models and specimens of sewage and drainage contrivances, cooking apparatus and food manufacturing machines, culinary utensils, specimens of food, adulterations, condensed fluids, preserved meats, light and cooling beverages, disinfectants, deodorants, antiseptics, and other things relating to the prevention of disease and preservation of health; hygiene in clothing and dress; plans and models of school-buildings, forms, desks, books, maps, and other articles used in teaching; and all sorts of appliances appertaining to the advancement of sanitary science, the promotion of education, and the improvement of the health and domestic comfort of the community at large. The exhibition will be open to exhibitors from all parts, and the management will be under the superintendence of a committee. A mere nominal charge will be made for space and admission—just sufficient to cover the costs of preparation and defraying the working expenses.

TO CORRESPONDENTS.—In reply to a correspondent (M., Manchester), we believe the "Little Dressmaker" is progressing well. It has not been noticed lately in this journal, simply because of delay in receiving copies.

At a recent meeting of the Victoria (Philosophical) Institute, Mr. Phené read a paper on "Prehistoric Traditions and Customs in connection with the Sun and Serpent Worship," which was illustrated with many diagrams.

APPLICATIONS FOR PATENTS.

CONTINUED FROM PAGE 106.

Harris. Deckle straps used by paper makers. —A. V. Newton. Apparatus for facilitating the feeding of brush-making machines (com.)—O. D. Deacon. Construction of ships' boats to be used for preserving life at sea.—S. S. Lewis and G. L. Hawkins. Process of cleaning cotton waste and other fibrous materials.—W. C. Stiff. Fastenings for metallic hoops or bands used in bailing cotton and other substances.

On April 29th.—1545 to 1558.—J. Cort. Apparatus for drilling and tapping cast-iron main pipes. — P. Harris, R. Harris, and W. Love. Apparatus for regulating the speed of marine engines.—G. Woods. Reed organs.—(Complete specification).—J. Barrow and W. Barrow. Improvement in kilns.—R. J. B. Mills Repeating ordnance, and cartridges therefor (com.)—H. Ciotti. A new centrifugal and re-acting pump.—A. Dobello. Machinery for cleaning, sorting, and flattening grains, especially oats.—M. Nolden. A water cleansing apparatus.—J. Blondel and E. S. J. Bruneau. Boilers and furnaces for generating steam.—W. R. Lake. Printing telegraph apparatus (com.) —W. Brown. Treatment of sewage and the manufacture of manure therefrom.—C. Russell. Apparatus for the manufacture of nitrate of soda (com.)—A. M. Clark. Preparation and employment of indigo-blue dye (com.)—J. T. Sprague Instruments for measuring electric currents, resistances, and forces

On April 30th.—1559 to 1570.—A. Strange, F.R.S., and K. H. Cornish. Machinery for preparing, spinning, or throwing and doubling cotton, silk, wool, and other fibrous or filamentous substances.—R. Roper. A new or improved captain's bridge, constructed as a self-launching life raft. J. Maignan and Jules Franck. Apparatus for stoppering bottles, vessels, and other recipients.—J. Holroyd. Apparatus for bowling, or projecting the balls used in the game of cricket.—R. Hill. Breech-loading small arms.—J. McSkimming. Improvements in umbrellas, sunshades, and parasols.—J. Stubb, sen. Sash weights and the manner of attaching new cords or lines to window sashes and frames.—J. E. Barraclough. Kitchen ranges.—E. W. A. Bartlett. Means for the relief and cure of diseases of the feet.—H. H. Henson. Construction of roads.—J. Ashworth. Motive-power engines.—A. V. Newton. Manufacture of explosive compounds (com.)

On May 1st.—1571 to 1578.—G. W. Rhoades. Construction and general arrangement of couplings for railway cars and other carriages, whereby the same are rendered automatic in their action.—H. A. Bonneville. Machines for piling textile fabrics (com.) (Complete specification).—G. Whight. Railway carriages (com.) —A. Browne. A new or improved process and furnace for the manufacture of metallic alloys (com.)—E. Duffee. Screens for coal dust purifiers. (Complete specification.)—T. Cullen. Apparatus for lowering and releasing or detaching ships' boats, and raising and stowing the same on board ship.—W. Clegg. Machinery for etching and engraving cylindrical and other surfaces.—P. O. Whitehead. Apparatus for damping warps.

On May 2nd.—1579 to 1594.—P. J. Davies. Apparatus for controlling, regulating, measuring, and arresting the flow or discharge of fluids or liquids, and preventing waste thereof.—W. F. Henson. Manufacture of raised or cut piled fabrics from certain materials.—W. M. Cameron. Life-rafts.—A. Henry. Breech-loading fire-arms.—H. H. Stevenson. Means or apparatus for propelling vessels.—F. Fisk. Electric printing telegraphs (com.) (Complete specification). —G. T. Bousfield. Torpedoes (com.)—C. A. McEvoy. Apparatus to be used when firing fuses by electricity.—H. Hus. Lamps for burning petroleum spirit and other highly volatile liquids.—A. J. Maher. Anti-friction axle bearings or boxes, applicable to tramway and other carriages.—A. I. B. Parent. Manufacture of buttons for garments.—A. M. Clark. Cigarette papers (com.)—C. J. Smith. Fire-escapes.—H. M. Kelshaw. Wire card covering for carding wool, cotton, silk, flax, tow, and other fibrous substances.—P. Hugon. Manometers.—J. T. Griffin. Ploughs and similar appliances, and apparatus for clearing the breasts of weeds and stubble, and for distributing manure and other bodies into furrows (com.).

On May 3rd.—1595 to 1608.—S. S. Williamson and D. Parsell. Steam engines.—S. S. Williamson and D. Parsell. Apparatus for pumping, draining, and ventilating, and obtaining and applying motive power, especially for use underground.—William Wright. Manufacture of gas for heating and illuminating purposes, and apparatus for the same.—D. Mudie. Construction of venetian blinds.—J. Ward. Manufacture of Portland cement.—J. Wotherspoon. Manufacture of asbestos packing for piston and valve rods, pistons, pipe joints, and other similar purposes.—C. P. H. Ochwadt. Slide valve gear for steam engines.—H. Defty. A new or improved apparatus or machine for scraping and cleansing the exterior, sides, and bottoms of ships afloat, and other floating or submerged bodies.—J. Booth and J. B. Gardam. Means for tipping or finishing fabrics made in imitation of seal skins and other similar fabrics.—J. M. Plessner. Motive-power engines.—J. Lott. New or improved appliances or apparatus for trimming the edges of straps, bands, and other articles.—D. Foster and W. Lockwood. Moulds for casting crucible, Bessemer, and other ingots. —J. H. Mills. Traction and tramway locomotive engines.—A. M. Clark. Machinery for making casks (com.)

On May 5th.—1609 to 1624.—J. Turner. Manufacture of sheep shears.—A. Rollason. Manufacture of floor cloths, roofing, and waterproof fabrics generally, some of the waterproofing material used in such improvements being also applicable as a varnish and cement, and for making solid materials, and coating ships' bottoms, and other rough purposes.—F. Wirth. Self-lighting gas apparatus (com.) S. S. Lees and F. Faulkner. Rousing apparatus for aiding the fermentation and facilitating the attenuation of saccharine worts and wash, and which is also adapted for producing a peculiar motion in any liquid requiring intermixture for bringing about certain definite results. J. Stubbs, W. Stubbs, and C. Stubbs. Apparatus for filling sacks or bags with ground salt, grain, or similar substances.—P. Charles. Apparatus for supplying water to water-closets, and for the prevention of waste of water admitted thereto.—W. Botwood. Improvements in carriages.—J. B. Langley. Water gauges for steam boilers and other purposes.—J. Gray. Apparatus for perfecting the combustion of fuel in the furnaces of steam boilers, and effecting the better ventilation of stokeholes in general, and those of over-sea steamers in particular.—J. O. Spong. Pipes or apparatus for use in smoking.—Sir G. D. Fitzgerald, Bart. Tubular steam boilers.—C. J. Galloway and J. H. Beckwith. Slide valves of compound steam engines.—J. J. Lish. Building with concrete, and constructing, combining, and using apparatus therefor. G. Haseltine. Manufacture of paper bags (com.) (Complete specification).—J. Imray. Process for smelting zinc, and apparatus therefor (com.)—H. Aspinall. Watches and chronometers. (Complete specification).

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On May 7th.—1641 to 1656.—G. Haseltine. Process and apparatus for effecting and maintaining a separation between two dissimilar liquids, or between a liquid and any substance held in solution or suspension therein, parts of which invention are applicable to the construction of galvanic batteries and to the refining of spirituous and vinous liquors (com.) (Complete specification).—G. W. Mallery. Apparatus for operating boats on shipboard.—C. F. Wood. Rotary motive-power engines, which may also be used as liquid pumps or meters.—A. C. Henderson. Direct hydro-caloric motors for more completely utilising the mechanical power of heat, and applicable as industrial motors, and as direct propellers in naval and fluvial navigation (com.)—A. C. Henderson. Puddling for puddling and boiling furnaces, and the mode of application thereof (com.)—J. M. Cutler. Steam and water valves (com.) (Complete specification)—W. Skelton and W. Mobberley. Steam boiler and other furnaces.—C. T. Liernur, C. M. De Bruynkops, C.E's., and Johann Martignoni, M.E. Screw-cutting gear.—S. Wheeler and E. Jerome. Machinery for making paper boxes, and similar articles.—F. H. Pattison. Construction, propelling, and steering of war steam ships or vessels.—W. L. Winans. Construction of steam vessels (com.)—H. W. Hammond. Apparatus for lowering boats (com.) —A. D. and A. J. Atkey. Machine for turning, shaping, slotting, drilling, and boring metals.—C. E. Hammond. Windmills.—W. T. Rowlett. Manufacture of boots and shoes, and toe tips for the same.—W. Mickle. Economising fuel used in habitations or buildings and for furnaces generally. (Complete specification.)

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On May 10th.—1693 to 1714.—A. Donald and A. J. Atkey. Stampers worked by fluid pressure for crushing ores and other minerals, parts of which improvements are applicable to steam or pneumatic hammers, rock drills, or other reciprocating apparatus worked by fluid pressure

for effecting percussion.—G. W. Rhodes and J. Barrett. Construction and general arrangement of locks or apparatus for locking and unlocking railway carriage and other doors.—S. W. Wilson. Wheels and parts connected therewith for railway carriages or vehicles.—W. Clark and R. Martin. Apparatus employed for clipping or shearing horses or other animals. G. Haseltine. Method of, and apparatus for, lighting and extinguishing gas-burners (com.)—P. Ryder and E. Brémond. Portable apparatus applicable to locomotive engines for preventing collisions on railways.—A. Morton. Manufacture of curtains.—B. Roberts. Applicable to the decks of ships.—W. R. Maguire. Water filter.—W. R. Lake. Moulds for oil cakes (com.)—A. G. Lanzirotti. System for operating the quadrature of circle.—G. H. F. Knight. Means of finishing silks, plush, and velvets, and producing lustre on the surface thereof.—I. A. Chomel. Applicable to ships' berths, parts of which improvements may be used for several various other useful purposes.—W. H. Bailey. Sound and flash-light telegraphs, part of which improvements are applicable to signal whistles generally.—J. Bennett. Construction of shuttles.—W. Robinson. Process for separating or removing the tin from scraps or cuttings of tinned or terne plates, and apparatus for that purpose.—T. W. Minton. Ovens for firing pottery, glass, and other substances.—W. Green. Breaks for railway and other carriages.—H. H. Murdoch. Apparatus for operating on cardings of wool or other fibre (com.) S. T. Dutton. Fittings for the connections of railway points and signals, and the means of fixing the said fittings to the ground.—A. M. Clark. Apparatus for lighting lamps, candles, and similar purposes (com.)—W. R. Lake. Mode of, and apparatus for, packing or baling cotton (com.)

On May 12th.—1715 to 1732.—A. Jamieson. Regulating the temperature of vulcanising apparatus for vulcanising india-rubber used in the manufacture of artificial teeth.—A. Henry. Breech-loading fire-arms.—W. S. Harrison. Transmitting, indicating, and recording time, signals, and the method of, and apparatus for, controlling horological instruments.—E. C. Barret. Propellers for steam or other motive-power vessels.—W. S. Croudace. Ships' compasses. W. J. Bodman. Improved harrow.—J. Kippax. Dobbies, or apparatus for actuating or controlling the movements of the healds in looms for weaving.—J. Kippax. Turkish towels and the manner of weaving the same, applicable also to the production of counterpanes or quilts, and some other woven fabrics.—J. Blakey. Machinery for boarding or softening and graining leather, and stocking or softening raw or dried hides.—J. Imray. Means and apparatus for employing chalk as fuel (com.)—C. Wigg. Manufacture of bleaching powder, and apparatus employed therein.—M. Mirfield and J. Scott. Machinery for combing wool, cotton, silk, and other fibres.—G. Finnegan. Means for converting reciprocating motion into rotary motion, and *vice versa*. P. M. Bdtus. Clips or shears for clipping or shearing horses and other animals.—A. Noble. Vents for heavy guns.—F. Savage. Agricultural steam engines. J. L. Baker and T. N. Cox. Horse-hoes. P. Keon and J. Dence. Apparatus for raising or elevating corn, minerals, coal, gravel, sand, or other materials, applicable for discharging or loading vessels, dredging, pumping, and other similar purposes.

On May 13th.—1733 to 1746.—J. Wyse. Equilibrium dead weight safety valve for steam boilers.—J. Darlington. Means of obtaining reciprocatory motion.—C. D. Abel. Means and apparatus for working brakes and communicating signals on railway trains by fluid pressure (com.)—A. Parkes. Metallic alloys.—W. R. Lake. Improved method of and apparatus for cutting out and repairing uncertain portions of veneers (com.) (Complete specification.)—L. S. Berg. Sewing machines.—J. H. Johnson. A repeating battery gun (com.)—W. Alldridge. Buttons.—R. S. Newall. Manufacture of magnesia.—A. Howatson. Construction of furnaces for heating, smelting, and puddling metals, and in the processes employed therefor.—E. T. Swainson and G. Haydock. "Leasing" warps in dressing machines, called "Slashers," which improvements are also applicable to other warp-dressing machines.—J. Butterill and J. B. Butterill, jun., and R. Wolstenholme. Arrangement and construction of steam boilers, and hot-water feed apparatus therefor.—G. G. Picking and W. Hopkins. Construction, arrangement, and working of steam cylinders for use in steam pumping machinery, and steam engines, and the means of governing or regulating the supply of steam thereto.—A. M. Clark. Furniture casters (com.)

On May 14th.—1747 to 1767.—J. Verran. Unsinkable boat.—L. J. Altman. Life belts or means for sustaining persons in the water.—E. P. H. Vaughan, F.C.S. Looms for weaving (com.)—J. Lewis. Washing machines.—S. Woodal. Coal tubs or waggons.—A. P. Potel. Joints for water, gas, steam, and other pipes.—F. A. Huntington. Steam boilers, and furnaces for heating the same. Complete specification.—W. Hodson. Manufacture of roof gutters and rain-water spouting.—W. C. Thomas. Mill for rolling flat bars of iron or other metal, and apparatus for adjusting the rolls of mills for rolling metallic sheets, plates, or strips (com.)—S. G. Rhodes and J. Miller. Tobacco pipes and cigar holders.—G. Kendall and R. Kendall. Modes and means for economising fuel, and apparatus therefor.—G. Ashcroft. Apparatus and the arrangement of same, for pumping fluids, to supply variable pressures to hydraulic presses for compressing and baling cotton and other fibrous materials and goods.—H. B. Fox. Joint or fastening for securing the ends of railway rails.—G. Ashcroft. Hydraulic presses used for pressing cotton, wool, hay, and other fibrous materials. G. Clark. Preserving and cooking animal and vegetable substances, and vessels, apparatus, and appliances for those purposes.—J. J. W. Watson. Permanent way of railways.—W. Gadd. Means or apparatus for the combustion of various oils for steam generation and other purposes.—Rev. G. H. Forbes. Gypsum cement or plaster.—J. Heap. —Screwing tackle, and apparatus for screwing metal tubes.—W. W. Symington. Net machines. —G. Mellor. Slings or apparatus for lifting and placing blocks of concrete, or stone, or other blocks, for constructing or building breakwaters, harbours, docks, foreshores for protecting river or sea banks, and other like purposes.

On May 15th.—1768 to 1784.—A. Kriéger. Brakes for tramways, railways, and vehicles moved by steam or horse power.—W. R. Lake. Journal or axle-boxes (com.)—W. R. Lake. Mechanism for facilitating the movement of traction engines (com.)—S. A. Luke. Apparatus for moulding small coal and other materials into blocks for fuel.—R. Wood and C. L. Clarke. Self-acting feed and low-water signal for steam boilers (com.)—P. H. Williams. Means of economizing fuel and apparatus employed therefor.—H. Footner. Railway sidings to facilitate the marshalling or arranging of the several vehicles of a railway train into any order desired.—J. W. Clayton. Apparatus or machinery for filling bottles or other vessels with blacking or other fluid.—E. Pilkington. Mounting rollers and reducing the friction in the bearings of the same, applicable to all purposes where rollers are used for exercising pressure. —T. Miller. Apparatus for re-capping central-fire cartridge cases.—J. Powell. Watering pots or cans.—F. T. Hughes. Spade bayonets and bayonet fastenings (com.)—S. S. Lewis. Process and apparatus for hardening, tempering, and annealing steel and other metals.—J. A. Wade and J. Cherry. Apparatus for pressing clay and other plastic substances in order to form tiles and other articles therefrom.—P. Kirk. Stoves and fire grates for use in dwelling-houses and other buildings.—W. R. Lake. Processes and apparatus for colouring, refining, and maturing coffee (com.)—W. W. Harrison. Manufacture of gas.

On May 16th.—1785 to 1794.—A. F. Gem. bowiecki. Advertising medium.—A. K. Fletcher. Manufacture of carbonates of soda and potash, and apparatus employed therein.—R. Hadfield. A new machine for fixing and setting wheels truly upon their axles and shafts, and an improved method for making such wheels, axles, and shafts, more particularly applicable to carts, colliery, tramway, and other similar wheels. (Complete specification.)—B. D. Healey. Manufacture of cast steel, and furnaces and apparatus therefor, also applicable to other metallurgical purposes.—R. A. Plunkett. Preserving stone, wood, and other substances from decay.—E. Bowen, jun. Improved needle threader.—B. Hunt. Manufacture of packing for stuffing boxes, and apparatus therefor (com.)—C. Eskrett and H. Searle. "Envelopes" or "hairs" used in extracting oil from oleaginous seeds and oil cake making.—S. B. Hewett. Construction of rotary or reversing fire-grates applicable to all kinds of fire-grates, stoves, and ranges. (Complete specification.)—G. T. Bousfield. Motive-power engines to be worked by steam or other fluid, applicable also to meters and pumps (com.)

On May 17th.—1795 to 1804.—W. R. Browne. Counterbalanced lifting bridges.—N. G. Olds. Carriage wheels.—W. H. Crispin. Construction of masts and spars for ships, the same also being applicable to the construction of telegraphic, railway, and other signal posts.—T. Whittaker. Apparatus for and means of extinguishing fires in mills, warehouses, and buildings, and vessels.—R. M. Caffall. Means of and appliances for automatically preventing the back rush of gas from gasometers, for purifying the gas, and for improving the brilliancy of the lights or flames of gas.—H. S. Maurel. Apparatus for ruling paper.—W. R. Lake. Band-saw machines (com.)—A. Rae. Deep sea, river, and lake safety bathing saloon to be used at all hours of tide, in any depth of water, and with safety to human life.—C. E. Smith. Machinery for making skelps for the manufacture of wrought-iron and steel tubes.—S. Brooks, G. Harrison, and T. Goodbehere. Machinery for spinning, doubling, and winding.

On May 19th.—1805 to 1816.—S. H. Hammett. Apparatus for regulating the supply of water to waterclosets and other places.—J. E. F. Lüdeke. Obtaining and applying motive power, and the machinery and apparatus to be employed therein.—W. A. Telling and S. Johnson. Gas meters.—J. Spear. Spring safety-valves.—W. F. Batho. Apparatus for excavating under water, and for raising and lowering materials in or out of water (com.)—W. Hansen. Means for fitting and joining together pieces of iron for foundation plates, voussoirs of iron bridges, segments of wheels, and such like purposes.—J. Pickup. Steam "Oliver," suitable for bolt and stud making.—A. Howatson and O. Williams. Furnaces.—J. Schlesinger. Unbreakable meerschaum and other pipes and cigar holders.—W. Stubbs. Machinery for the manufacture of bricks.—G. W. Scollay. Method or mode of preserving animal meat or matter to be used for food or other purposes. (Complete Specification.)—Rev. G. H. Forbes. Compound for the manufacture of lime, cement, or plaster, capable also of being used as an artificial fuel.

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THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

Chairman of the Council—**SIR ANTONIO BRADY.**

THE various efforts which have been made, and the numerous influences now at work to injure, if not to destroy, Patent Rights, the inefficiency of the many well intended, but ill considered, schemes of Patent Law Reform which have from time to time been suggested, and the tendency of which has generally been to prejudice the Inventor, without advantage to the Public, together with the proceedings so essentially involving the interests of Inventors which have already taken place in Parliament, show the necessity of an immediate and active co-operation on the part of those interested in Inventions and in Patent Property, and that an Association for the Protection and Defence of Patent Rights is urgently needed. This Institute has, therefore, been established for the purpose of uniting and organising the influence of Inventors, Patentees and others. Its objects are:—

1st. To protect Inventors' interests and defend the privilege of obtaining her Majesty's Letters Patent.

2nd. To promote improvements in the Patent Laws.

3rd. To facilitate the diffusion of information with reference to Inventions and other subjects beneficial to Inventors and Patentees.

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APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur street, Charing Cross.

On May 20th.—1817 to 1835. R. W. Hailstone. Ships' telegraph and indicator.—E. A. Paillard and Z. Goulan. Apparatus for opening preserved meat, fish, potted meat, and other tins.—J. Viles. Glove for cleaning and polishing plate and for other similar purposes.—J. Smart. Stocks and dies.—J. Blakey. Machinery for stretching boots and shoes.—E. A. Cowper. Machinery for sewing a sole on to a boot or shoe.—H. Lomax, G. F. Bradbury, T. Chadwick, and T. Singleton. Sewing-machines.—I. A. Vacherot. Propelling and apparatus to be employed therein, which apparatus is also applicable as a ventilator.—L. Sterne. Railway carriages.—F. Crowley. Breach-loading small-arms.—H. Adams. Revolving pistols.—G. Jones. Tobacco pellet for charging smoking pipes.—J. W. Lee. Traction engines and boilers.—S. J. Mackie and C. Faure. Explosive compounds.—W. R. Lake. Wheels for vehicles. R. G. H. Forbes.—Compound for the manufacture of cements or artificial stone, capable also of being used as an artificial fuel.—G. L. Scott. Blast furnaces, foundry cupolas, and other furnaces for melting or re-melting iron and steel.—H. E. Newton. Hydraulic engines for raising water and for obtaining motive power.—J. J. McComb. Mode or method of uniting or connecting metallic bands or sheets (com).

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On May 24th.—1876 to 1886.—W. Black. Registering apparatus, particularly applicable for tramway carriages and other vehicles.—W. Radeke. Balls or blocks of artificial fuel for heating or burning purposes only.—T. A. Hearson. Speed indicator, or strophometer.—J. Smith. Looms for weaving.—J. Jowett. Reeds or slays used for weaving.—E. T. Gardner. Safety magazine lamps.—A. V. Newton. Bale fastenings (com.)—W. R. Lake. Harvesting machines (com.)—A. M. Clark. Machinery for cutting, preparing, and moulding peat for fuel; also applicable for moulding other plastic materials (com.)—B. Green. Storing and treating sewage.—F. Jenkin. Construction of V pulleys for the transmission of power.

On May 26th.—1887 to 1899.—W. W. Box. Apparatus used in the manufacture of gas.—H. Bisson. Plugs and stoppers.—A.

Sington. Cop tubes used in the textile manufacture (com.)—E. Hayworth. Steam boilers (Complete specification)—H. H. Henson. Road paving.—A. Browne. Cartridges with special wads, applicable to all classes of fire-arms and ordnance (com.)—J. Watson. Stove for warming offices, halls, churches, and other rooms.—W. H. Spencer. Process of and apparatus for manufacturing illuminating gas.—A. Lutschaunig and J. Ricketts. Appliances for obtaining high temperatures.—C. Johnson. Machinery or apparatus required for traction and other purposes. J. C. W. Jefferys. Scarf rings.—J. H. Johnson. Hulls of ships (com.)—H. Hampson, A. Hellewell, J. Kenyon and W. Chantler. Apparatus or means of heating the brims of hats preparatory to the operation of curling or shaping.

On May 27th.—1900 to 1910.—W. J. Clapp. Machinery and apparatus for cutting coal and for other similar purposes, and in the mode or method of using and working the same.—W. Morgan-Brown. Sewed or seamed hydraulic hose (com.) (Complete Specification)—H. Schallehn. Apparatus for effecting more complete combustion in furnaces, especially locomotive engines (com.)—C. W. Cooke. Apparatus for winding electro-magnets with insulated wires.—A. Barraclough. Apparatus for dewing, damping, and oiling fabrics and fibrous materials.—H. Hahn. Railway and other wheels (com.)—F. Stanfield. Means for preventing fraudulent alterations in bankers' cheques and other like monetary instruments or documents.—W. E. Gedge. Application of jointed or articulated traction apparatus to various agricultural machines, and particularly to mowing and reaping machines (com.) J. Tatham. Machinery for preparing wool, cotton, and other fibrous materials for spinning.—J. Maude. Chaff cutting machines.—F. Curtis. Cloth wringers (com.)

On May 28th.—1911 to 1930.—J. Tindal. Finishing cloth and machinery or apparatus employed therefor.—A. T. Holland. Cutting of garments and apparatus used therefor (com.)—S. W. Torrey. Rafts, chiefly designed for preserving life at sea.—N. Clayton and J. Shuttleworth. Thrashing machines.—W. C. Flood. Meter for water and other liquids.—J. Schmidt. Tramway rails and wheels.—J. Kidd. Air or vapour gas machines and apparatus connected therewith.—J. Murphy. Wheels and axles.—F. E. B. Beaumont. Rock or stone drilling apparatus.—M. Burke. Boat davits.—W. G. Reeve. Inkstand.—W. R. Lake. Apparatus for generating vapour from bi-sulphate of carbon.—S. Polle. Horse rakes.—F. Curtis. Steam for motive power and valves of engines for receiving such steam (com.) (Complete specification)—W. M. Scott. Machinery for spinning tobacco. J. Maxfield and Joshua Maxfield. Tea pots and other hollow articles or vessels of metal.—M. Evrard. Apparatus for washing and sorting coal and minerals. W. I. Wise. Machine for potato sowing (com.)—W. Marrian. Metallic bedsteads and other articles of metallic furniture.—W. R. Lake. Sewing machines (com.)

On May 29th.—1931 to 1950.—C. Thomson. Elastic beds, seats, and other supports or cushions (com.)—H. B. Fox. Locks or expanding fasteners for closing and securing books, albums, folios, dispatch boxes, and various other articles.—R. Werdermann. Process for the production of aluminium.—R. Werdermann. Process for the conversion of chlorides and fluorides of alkaline metals and alkaline earth metals into oxides, hydroxides, and carbonates.—E. Humphries. Straw shakers, to be used in connection with thrashing machines.—C. Hanson. Apparatus for the cutting of coal.—G. S. Robertson. Appliances for relieving life-boats from water.—C. D. Abel. Machinery or apparatus for breaking and scrutching flax, hemp, and such like fibres (com.)—E. D. Risque. Bottles for containing aërated or gaseous liquids, and stoppers for the same.—A. Bresson. Manufacture and preparation of asphalte.—W. Murphy. Apparatus employed in concrete building.—A. V. O'Dwyer. Apparatus for feeding young animals with milk and other fluids.—F. Smith. Apparatus for spinning, doubling, and twisting wool or other fibrous substances.—P. Samain. Breech-loading fire-arms. (Complete specification) J. Imray. Anchors (com.)—J. Imray. Caloric engines (com.)—J. H. Johnson. Apparatus for determining and indicating the rate of speed of machines, carriages, and the surfaces of bodies when in motion (com.) (Complete specification)—J. M. Stanley. Marine and other boiler fire-places or furnaces.—J. Simpson. Steam engines, part of which is applicable to supplying water to steam boilers.—J. Elce and H. B. Arundel. Machinery for spinning and doubling.

On May 30th.—1951 to 1959.—F. Durham. Indicating or checking apparatus.—A. V. O'Dwyer. Feeding young animals of the milk drinking species.—J. R. Martin. Elastic packing, more particularly applicable to rotatory engines and pumps.—W. B. Woodbury. Photo-mechanical printing, and apparatus and appliances therefor.—C. C. Cramp. Hydraulic carriage washing brush, which may be used for other purposes.—T. J. Smith. Appliances for economizing fuel in stoves, grates, and furnaces (com.)—R. Weare. Dry closet.—F. Dening. Seed and manure drills.—H. Duckham. Hydrostatic weighbridges and platform weighing machines.

On May 31st.—1960 to 1978.—A. Ray. Smoke-consuming furnace capable of being adapted to any purpose (com.)—E. H. Bramley. Easels, writing tablets, tables, and desks on an improved principle.—P. H. Levi. Spring closing joint, applicable to certain articles of jewellery and other purposes.—F. A. Paget. Railway brakes (com.)—D. G. Straight and S. Straight. Keys of pianofortes and other similarly keyed musical instruments.—D. Mills. Boot and shoe soles and apparatus therefor (partly com.)—J. Lamb. Apparatus or arrangements for feeding, heating, and circulating water in steam boilers, and for burning liquid and gaseous fuels in combination with solid fuels in steam boiler and other furnaces, and thereby economising fuel and preventing smoke.—J. Townsend. Treating sewage or other liquids or substances containing nitrogen, phosphorus, or their compounds, in order to deodorize or precipitate the same, and obtain useful products therefrom.—H. H. Henson. Roadways.—I. L. Pulvermacher. Metal plates, positive and negative, and methods of attaching or connecting plates or elements to form chains or batteries for medico-electric and other purposes, also appliances connected therewith for the application of electric currents.—M. Evans. Apparatus or mechanism for signalling in, operating the brakes, and fastening the carriage doors of railway trains.—J. I. Mills and T. S. Monkhouse. Printing and apparatus for cutting the printed matter at the same time.—D. Tallermann. Meat stands and dishes for facilitating the carving of preserved or potted meats.—J. Wyatt. Apparatus for signalling between the different parts of railway trains, and partly applicable for opening and closing the doors of railway carriages.—W. Taylor and T. Newall. Indicators, and apparatus for preventing the spread of fire in mules for spinning and doubling.—S. Kay and T. Kay. Demulcent and nutritive lozenge, a mixture, and an aperient pill.—S. Kay and T. Kay. Stoppers and stoppering bottles.—P. Matthey. Fitting up ships for carrying cattle (com.)—F. Wirth. Ropes and carriages employed upon tramways, and the apparatus connected therewith (com.)

On June 2nd.—1979 to 1982.—R. Swift. Saddles. G. Cockburn. Safety valves.—A. Jack. Thinning turnips and other root crops, and the machinery or apparatus employed therefor.—W. R. Lake. Writing ink and apparatus therefor (com.)

On June 3rd.—1983 to 1995.—B. J. B. Mills. Governors for steam engines and other motors (com.)—E. Whalley. Machines used for winding textile or fibrous yarns or threads on to bobbins or spools.—B. Anderson and J. Harrison. Packing leathers for hydraulic purposes, and the arrangements of machinery or apparatus to be used in their manufacture.—H. P. Scott. Anti-corrosive and protective composition.—W. P. Butchart. Carding jute, hemp, flax, and other fibrous substances, and the machinery or apparatus employed therefor.—W. R. Lake. Collars, and clasps for the same (com.)—J. Heap. Dry closets, commodes, and urinals, and shafts and receptacles for receiving and discharging human excreta mixed with dry, absorbing and deodorizing and disinfecting vegetable or other substances.—J. G. Willans. Castings.—R. Brydon and J. Shepherd. Machinery or apparatus for drilling, boring, or cutting rock or other hard substances.—F. B. Little. Watering pots.—G. Shand. Treating textile materials and fabrics in order to preserve them from mildew and to diminish their affinity for moisture.—T. Hacking. Steam boilers.—A. V. Newton. Compensating spring balance for safety valves (com.)

On June 4th.—1996 to 2001.—J. W. Melling. Safety and relief valves.—E. Milner. Means for facilitating the economy of fuel in steam boiler and other furnaces or fire-places; also applicable in heating apartments or other places.—F. Randell and H. Randell. Double-furrow ploughs.—G. H. Forbes. Cements.—I. Baggs. Gas and gases for illuminating and other purposes, and apparatus to be employed in connection therewith.—T. Blumlein. Saddle-trees.

On June 5th.—2002 to 2015.—J. W. Clinch. Machine for gumming labels and other similar articles.—P. Brotherhood. Engines worked by fluid pressure, such engines being also applicable as pumps for lifting or forcing fluids.—R. Milburn. Apparatus adapted to be employed in the drying and comminution of peat and some other matters.—A. S. McWilliams. Sheep shears, the same consisting in providing a thumb rest and guard upon one blade of the shears, and finger rests upon the shank or back edge of the opposite blade. (Complete specification)—C. W. Siemens. Apparatus for producing and regulating electric currents, such apparatus being particularly applicable for electric lighting (com.)—T. Shelmerdine. Polling stations to meet the requirements of the Ballot.—D. Currer. Implements for cultivation, of steam, water, wind, or animal power.—J. E. Russell. Tucking devices and guides for sewing machines (com.)—H. A. Bonneville. Covering surfaces with wood (com.) (Complete specification.)—W. Willis. Photo-chemical printing.—A. M. Clark. Stone-cutting machinery (com.) (Complete specification)—H. Handyside. Locomotive engines, and apparatus for accomplishing the safe ascent of steep inclines, and for facilitating the passage of sharp curves.—R. Balfour. Machine for thinning turnips.—A. V. Newton. Electro-magnetic engines or motors (com.)

On June 6th.—2016 to 2027.—G. T. Livesey. Apparatus used in the manufacture of gas.—J. Kidd. Gas burners (com.)—W. F. Jobbins. Apparatus for washing glasses, dishes, and other similar vessels (com.)—W. Smith and L. J. Smith. Electric time ball apparatus.—P. Frank. Watch-case springs and fasteners for the same (com.)—J. Shanks. Valves and waste preventive apparatus for water-closets, baths, lavatories, and similar apparatus.—W. H. Sterling. Preservation of iron. (Complete specification.)—G. T. Bousfield. Door locks (com.) (Complete specification)—J. S. Gabriel. Machinery for smoothing stone.—A. Simpson. Cattle food. J. J. Bulmer. Apparatus for extracting moisture from potters' clay and compounds thereof, cementing compounds, sewage, sludge, brewery residues, and various other substances, and for drying and calcining some of the above-named and other substances.—H. T. Christie. Apparatus for saving life at sea.

On June 7th.—2028 to 2037.—T. Beams. Apparatus for heating the feed-water of locomotive and other engines for boiling liquor in brewers' and dyers' vats, and for other like purposes.—J. Gilbert. Obtaining and applying motive power.—N. Kennedy. Self-acting temple for looms for weaving.—M. Miller. Apparatus for distilling alcoholic spirits.—T. F. Wintour. Ventilators.—C. T. Colebrook. Steam cylinders for steam pumping machinery and steam engines. T. Clunes, W. Holland, and S. T. Dutton. Machinery or apparatus for working and interlocking points and signals on railways.—J. Mitchell. Syphon ventilators.—W. Dargue. Machinery or apparatus to be employed in dyeing wool, silk, cotton, flax, or other fibrous substances in the hank or skein.—G. Horner and A. Dobson. Steam boilers or generators.

On June 9th.—2038 to 2049.—J. B. Leslie. Instrument or apparatus for indicating the direction of ocean and other currents.—D. Halpin and J. H. Abbott. Machinery and appliances for the manufacture of sugar from cane.—E. J. Hahn. Hydraulic blast apparatus.—G. Goldsmith and J. Dilkes. Self-acting gates or sluices and weirs for the prevention of the overflow of water from rivers or watercourses.—M. Hatschek. Mashing and filtering for breweries, and apparatus therefor.—S. Cotton. Machinery for heckling flax and other fibrous materials.—M. H. Gerring. Steam engines.—E. T. Hughes.

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Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE.

AUGUST 1, 1873.

THE PATENT OFFICE AND ITS SURPLUS FUND.

Perhaps no man has of late years been more used to point a moral than Mr. Leonard Edmunds, sometime Clerk of the Patents and of the Commissioners of Patents for Inventions, a man to our mind most hardly dealt with. Some few years ago he was continually referred to by certain parties as the great stumbling block to the beneficial development of the Patent Law Amendment Act, and it was naturally expected that as soon as he ceased to hold office all sorts of things would be done at Southampton-buildings for the advantage of inventors. He has now left the scene of his former official life some years, and still we are at a loss to perceive that the good time coming has yet arrived. We are still obliged, on resorting to the Patent Office, to refer to Indexes that require an experienced guide in order to enable us to use them aright,—and those very valuable helps to inquiry into the novelty of inventions, the Books of Abridgments, are so far behind every-day requirements that as systematic aids to research it may be said they are of very small value. After more than twenty years we still have innumerable subjects on which no such books have been issued, and of those already published not a few terminate with information as to patents granted many years ago. Moreover, since Mr Edmund's time, the very objectionable rule that applicants for patents should themselves supply abridgments of their provisional and complete specifications, filed with applications, has been promulgated,—a rule that tends to produce inferior and unreliable abridgments in the place of superior and reliable ones. Further, nothing has been done to apply the surplus of the Patent Office Fund which annually accrues from patent fees and stamp duties to purposes advantageous to inventors, although this surplus is no more the property of the Government than the interest on the National Debt is their property to use as they please without regard to the just rights of those who have a direct interest therein. We are not quite sure that if everything were done by our Patent Office which it is to the advantage of the inventor and the public that it should do, that the surplus would then be so considerable as it now is. We have often advocated that the Patent Office should be housed in a building, the convenience and even magnificence of which should be equal to the high national importance of the patent system, and the political and industrial greatness of this country, and that there should be a Museum of Models and Specimens technologically arranged in some central portion of the metropolis—not in an out-of-the-way corner at South Kensington—and a library of the most perfect kind, comprising a complete collection of patent lore, technical and industrial literature. And although without a change in the law, and one which is by no means settled upon as desirable, the examination of applications for patents before granting them cannot be carried out,—yet, official directors of searches might be appointed who could assist inventors to inquire into the novelty of their inventions for themselves, and thus avoid the scandal of invalid patents being granted; because, as is now the case, it is less troublesome and expensive to take out a patent at the risk and peril of its entrenching upon one already granted than it is to search the Patent Office for prior patents bearing on the matter of the intended patent. Officials of the kind we allude to would not be simply library attendants, for the Patent Office has already retained the services of most excellent officers of that class; what is required being men of high class as technologists, who should preside over and direct the library attendants, and advise the inventor as to the course to pursue in order to ascertain without excessive labour the status of his invention as to novelty. High officers of this kind would require to be paid salaries nearly as large as that of the chief officer, and must be surrounded by an efficient staff of assistants.

As all this need not entirely absorb the patent fund, we would suggest that in the patent office building provision should be made for experimental and test workshops and laboratories available for all patentees and applicants for patents. Furthermore, that in fitting cases inventors should receive pensions or grants from the surplus fund. Surely those who have been exercising their talents in matters which tend to the advancement of the prosperity of the country are, when in need of it, fit recipients of public bounty, especially when, as in this case, the means of bounty issues out of resources that the recipients have themselves helped to create. Lastly, we suggest that the Inventors' Institute is entitled to share in the division of the spoils. It has now been in existence more than ten years, and has created a bond of union amongst inventors such as many very good judges deemed absolutely impossible at the time that Mr. R. M. Latham, Mr. R. Richardson, Mr. H. Williams, Mr. Campin, Mr. Curtlar, and others helped the Institute into existence. Not that it wants State aid to keep it alive, but it would be all the better for having commodious lodgings assigned to it in, or contiguous to, the Patent Office.

There is no desire on our part to ask for anything more than we deem to be strictly just and equitable; but we do hold that if any mulcting of the inventor because he claims remuneration in respect of the results of his ingenuity (for this is the nature of the system of charging him any fees or Government dues whatever on his patent grant) be considered sound policy—which we, however, utterly deny—then we hold that not one penny should be taken from him beyond what is necessary to sustain in efficiency a Public Patent Office, and perhaps to pay the Exchequer such stamp taxes as are usually imposed upon documents which enable a man to obtain the benefit of the judicial power of the country for the protection of his property when needful. If anything should happen to be levied on the inventor beyond this, in such case it ought to be returned to him again in specie, or in valuable advantages, which he may avail himself of if he wishes so to do.

We are not quite sure that this question of Patent Office surplus is properly understood, and we do not think it ever will be unless the history of the Patent Law be referred to. Previously to the Act of 1852 it was necessary that a man should, in order to get a patent, do suit, and pay fees, to no less than three Cabinet Ministers, through whom her Majesty was to be moved to be graciously pleased to grant him a patent. He had also to satisfy the myrmidons of the Chancellor of the Exchequer, who made him pay more than *fifty pounds* for stamp duties alone on each patent granted.

When the Act of 1852 passed all these fees and proceedings were abolished, an entirely new procedure and fiscal arrangements being substituted; certain Government dues or official fees being required to be paid at or before the grant of the patent, and at the third and seventh years of its duration, these being intended to support the Patent Office, whilst some stamp duties were reserved for the advantage of the *Inland Revenue*,—so that beyond the amount of such Inland Revenue stamp duties and the expenses of the office, the money received was unappropriated by Parliament, being always understood as intended to be used for purposes advantageous to inventors and the public. The result has been that a surplus has been accruing at the rate of somewhere about *sixty thousand pounds* per annum during twenty years past, which we say it is high time should be applied to the benefit of inventors and the promotion of inventive progress, and we feel assured that if inventors will only bestir themselves some such application will soon be made of it.

Reviews.

Sanitary Engineering; A Guide to the Construction of Works of Sewerage and House Drainage, with tables for facilitating the calculation of the engineer. By Baldwin Latham, C.E., M. Inst. C.E., past President of the Society of Engineers, &c. London: E. and F. N. Spon, 48, Charing Cross. New York: 446, Broome-street. 1873.

In the present day no species of knowledge is of such importance as that relating to the health preserving arrangements which should be adopted in order to render our homes pure and sweet. Now that such large portions of mankind have abandoned the woods and fields, and congregated together in towns which they glory in expanding, thus shutting out nature farther and farther from them, it becomes a life and death necessity to compensate for nature's purifying influences by the application of scientific knowledge in the formation of sewers, drains, and other appliances for overbalancing in favour of life the death-tendency of decay and waste. The sanitary engineer whose business it is to deal with such matters as these exercises—therefore one of the most important of the professions amongst us, yet up to a very recent period it was a profession in which science held a very insignificant position, rule of thumb men and empirics being much more numerous than men of scientific knowledge or intelligent technical training. Happily we are now obtaining a better class of practitioners, and amongst them no one ranks higher than Mr. Baldwin Latham; hence we are not surprised to find that his present work is worthy of all praise, whether considered from a scientific or practical point of view. In the first pages of the work before us Mr. Latham refers to the necessity of sanitary measures, on which we add nothing to the remarks we have already made. He then proceeds to consider various plans proposed in carrying out sanitary works, as to which he remarks that the success of the prosecution of such works is more dependent upon the character of the work, executed than upon any salubrity or insalubrity of climate. This is seen from an examination of the rates of mortality in some continental towns. For example, we find that both Brussels and Paris, which have climates far more salubrious than that of London, have nevertheless a higher rate of mortality than London, proving conclusively, that the sanitary works of London are of a more effectual, and therefore more perfect character, and that they better fulfil their mission than those adopted either in Brussels or Paris.

Various modes have been proposed from time to time for effecting, or perfecting, the appliances within our towns for the removal of all decomposing matter, and various agents have been suggested for use in connection with the removal of those accumulations of filth and dirt which have been found to be so prejudicial to health and life. All the elements known to the ancients have been laid under tribute for this purpose; fire, air, earth, and water have all been proposed and adopted in their turn, as sanitary agents to be used in connection with the removal of such matter, and for securing the great objects sought by the sanitary engineer. The advocates of fire recommend that all the waste products of our towns and populous places should be committed to the flames.

A second set of advocates would have us believe that air is the best agent for removing these matters, and that the pneumatic is the proper system to be adopted.

A third set of advocates recommend earth-earth as by far the best agent that can be used in connection with the removal of all fæcal and decomposing matter from the habitations of the people; whilst a fourth set of advocates maintain that the water-carriage system is the best, and the only feasible plan that can be adopted under the varied requirements of town population.

Upon careful consideration it must be seen that none of those agents which have been proposed fulfil all our requirements, when we have to deal with the question of removing, not only the fæcal matter, but other refuse from the houses and manufactories of our towns. For example, fire, air, and earth are of little use for removing and disposing of liquid filth; whereas water and air are incapable of being applied so as to deal with a very large mass of the accumulating matter of our towns, namely, the sweepings from streets, ashes, and solid garbage from houses, all of which are now required to be removed by manual and horse labour. Air and water have been proposed as the medium by which decomposing matter shall be conveyed through a properly-constructed system of pipes, or tubes, out of our towns, and then used for agricultural purposes. Fire has been recommended simply as a means whereby decomposing matter may be destroyed, or rather converted, by rapid oxidization, into harmless elements. Earth and other materials of this character have from time to time been recommended and used, more with a view to deodorize and fix the elements of decomposition, so as to render the matter to be dealt with less baneful in its effects on health when accumulating in towns, and also as a means of preserving its manurial value.

Of all the systems that have been proposed, the water-carriage system is, in the opinion of the author, the best adapted to the varied requirements of a town population for effecting the speedy removal of the principal matter liable to decomposition. It will also be found equal to any other system in securing the manurial elements that have to be utilized, but it should not be overlooked that other systems are applicable, and may be adopted with manifold advantage when the circumstances are such as to debar the entire use of water-carriage.

The author then deals with the area and plans of the district to be sewered, the consideration of rainfall with reference to sewers, the water supply of a district; self-cleansing sewers by securing a proper velocity in the flow of the sewerage, and on this point he supplies some voluminous practical tables. The course of sewers is fully discussed, and the construction of sewers fully treated, and as an example of the thorough-going practical character of this work we may cite the following:—

In carrying out works of sewerage one of the most important points for the consideration of the engineer is the proper mode of forming the junctions with sewers. In the early sewerage works of this country the ordinary house-drains were usually placed at a level from 18 inches to 2 feet above the invert of the sewer, in order to ensure the drains being kept open or free from the deposit which it was known would surely take place in the imperfectly constructed sewer work of that period; but now that the principle of forming sewers is better understood, and as sewers ought not now to be any longer liable to accumulations of deposit, and as the mode of forming junctions very materially influences the working of a system of sewers, this work should be performed in a proper and scientific manner. It should be laid down as a rule that branch sewers, or drains communicating with sewers, should be made to discharge into the main sewer in the direction of the established current of the sewer, and that the velocity of the discharge of the subsidiary sewers or drains should at least equal that prevailing in the main sewer. Right-angled junctions, both lateral and vertical, have been and are still used for forming the junction with sewers; such junctions, however, have the effect of producing eddies, which check the flow in the sewer, and lead to injurious accumulations of deposit.

The author then illustrates his remarks by reference to diagrams, and adds—

It is customary in practice, when curved junctions are formed, to give the branch sewer or drain a rather greater amount of fall in the curve, in order to make up for the resistance of the bend. Junctions made at points above the flow of the ordinary water-line in the sewer, even when joining the sewer at an angle, act prejudicially in causing eddies by diminishing the velocity. For example, a junction made in the crown of the arch of the sewer, produces the same effect upon the flow as a junction at right angles; because a body of water falling from a height on to a surface of a flowing stream, retards the velocity in the same way as a right-angle junction. The proper position for a junction is within the water-line, but not so low that the flow from it would be checked by the sedimentary deposit that will be rolled along the bed of the sewer. It will be seen that when junctions are so placed that the outfall of a house drain will be below the water-line, the drain will be trapped at its outlet, and therefore the ventilators of house drains cannot judiciously be used to ventilate sewers, and moreover house drains, by reason of the sealing of their outlets, require special means for ventilation. The junctions between brick sewers, and pipe sewers, or house drains, should be formed by the use of a proper junction block.

These blocks may be built into the sewer as the work proceeds, or may be inserted afterwards. Such blocks are made of fire-clay, or of stoneware, and the branch enters the sewer in an oblique direction, and forms the best mode of terminating pipe sewers or drains with brick sewers, otherwise, where pipes are used to form the junction, it is generally necessary to cut them to fit the brickwork at the proper angle, and in cutting pipes the work is not usually so carefully done but that some imperfection remains, which detracts from the merit of the work. The junctions of pipe sewers, or drains with pipe sewers, when curved, are struck from a centre at right angles with the centre line of the pipe, the inside of the straight pipe meeting the inside of the branch at a tangent on a radius line from which it is struck. Where more pipes than one are required for forming a junction, the end of each pipe should, when manufactured, be cut to the radius of the curve with which they are described. The greater the radius of the curve used in forming a junction with a sewer, the less will be the resistance offered to the flow, and the more perfect will be the work. Where sewers are laid in straight lines they may communicate at right angles when they discharge into manholes the outlet from which is placed at a lower level than the inlet. This arrangement requires extra fall to be taken at the manholes, in order to secure the advantages of having the sewers laid in straight lines for facilitating the purpose of examination. The junctions between brick sewers and brick sewers are of nearly similar size. The plan usually adopted is to construct a bell-mouth, which receives the sewer at its largest end, and gradually diminishes at the lower end to the size and shape of the sewer, which will convey the whole volume to be discharged; but where small sewers meet larger sewers they usually join with a curved junction.

The work also contains remarks and directions as to the flushing arrangements of sewers, ventilation of sewers, and many practical details profusely illustrated by engravings.

Light Science for Leisure Hours. Second Series. Familiar Essays on Scientific Subjects, Natural Phenomena, &c., with a Sketch of the Life of Mary Somerville. By Richard A. Proctor, B.A., Camb., &c. London: Longman, Green, and Co. 1873.

Mr. Proctor, in these essays, has fully equalled any of his former productions, and in saying this we wish it to be understood that they possess the highest order of merit, for although the branches of knowledge he treats of are profoundly scientific, yet the manner in which they are dealt with by him is such that any person of moderate education who takes an interest in them will find information presented in a form that will be at once available for his use.

The first pages of this volume Mr. Proctor devotes to a memoir of the late Mrs. Somerville, whose death we recorded in our pages some time ago, and this we shall quote from at some length, as we deem her worthy of the highest public regard, not only as an eminent worker in the cause of science, but as a woman who found her true place in the world without resorting to unseemly clamour for woman's rights, or striving after unwomanly power. She was truly honourable and useful, and well deserves a conspicuous place in the annals of fame.

Mary Somerville (*née* Fairfax) was, it appears, born at Jedburgh on December 26, 1780, and died on November 30, 1872, at Naples, aged nearly ninety-two years. In considering her education, we have not to mention important seminaries, where skilled teachers make it their chief business to impart to others the knowledge for which they are themselves eminent, but to speak only of studies pursued in the calm of a quiet home. This, rightly understood, is perhaps the most remarkable feature of her career. There are few mathematicians so eminent as she deservedly was, in whose fame great public schools and universities do not in some degree partake. But we owe almost to accident the discovery of the powers of Mary Fairfax's mind, while the gradual development of those powers proceeded under the guidance of tutors unknown to fame, and with access only to such assistance as could be given by the friends of her own family.

Mrs. Somerville has herself described how it chanced that the peculiar powers of her mind came first to be recognized. She was in the habit of working at her needle in the window-seat, while her brother took his lessons in geometry and arithmetic. Fortunately (in her case) the work which is regarded as most suitable to the capacity of women leaves the mind unoccupied; and consequently there was nothing to prevent Mary Fairfax from attending to the lessons intended for her brother. She gradually became interested in the subject of these lessons, and took care not only to be present regularly, but to study her brother's books in her own room. It happened that, on one occasion, young Fairfax failed to answer a question addressed to him, and his sister involuntarily prompted him. The tutor was naturally surprised that the quiet Mary Fairfax should have any ideas beyond the needlework which had apparently engaged her attention; but, being a sensible man, he was at the pains to ascertain the degree and soundness of her knowledge, and, finding that she had really grasped the first principles of mathematics, he "took care that she should have liberty to go on in her own way." If a boy had shown similar fitness for mathematical research, anxious attention would have been devoted to the choice of books and teachers, school and university; but the case of a girl showing such tastes seemed to be adequately met by according to her the privilege of following her own devices. We shall never know certainly, though it may be that hereafter we shall be able to guess, what science lost through the all but utter neglect of the unusual powers of Mary Fairfax's mind. We may rejoice that, through an accident, she was permitted to reach the position she actually attained; but there is scarcely a line of her writings which does not, while showing what she was, suggest thoughts of what she might have been.

While studying mathematics "in her own way," she found a difficulty which for a time threatened to interfere with her progress. She was unable to read the "Principia," because she could not understand Latin. In this strait, she applied, "after much hesitation," to Prof. Playfair. She asked if a woman might, without impropriety, learn Latin. After ascertaining the purpose which the young lady had in view—possibly in doubt lest she might follow in the steps of Anne Dacier—Prof. Playfair told her that it would not, in his opinion, do her any harm to learn Latin in order to read the "Principia." It is noteworthy, as having probably a bearing on the course which Mrs. Somerville's reading subsequently took, that Playfair was one of the few in this country who at that time appreciated the methods of the higher mathematical analysis, and had formed a just opinion of their power—"a power, however," as Sir John Herschel well remarks, "which he was content to admire and applaud rather than ready to wield." His excellent review of the "Mécanique Céleste" probably gave (as Herschel suggests) a stronger impulse to the public mind in the direction of the higher analysis than he could have communicated by any researches of his own.

It was not, however, as a mathematician that Mrs. Somerville first became known to the world. A subject of research, exceedingly difficult and only to be pursued successfully under very favourable conditions, was undertaken by her during the life of her first husband, Captain Greig, son of High-Admiral Greig of the Russian Navy. She sought to determine by experiment the magnetizing influence of the violet rays of the solar spectrum. "It is not surprising," says Sir John Herschel on this subject, "that the feeble though unequivocal indications of magnetism which she undoubtedly obtained should have been regarded by many as insufficient to decide the question at issue." Nevertheless it was justly regarded as a noteworthy achievement that, in a climate so unsuitable as ours, any success should have been attained in a research of such extreme difficulty. That she achieved, and, what is more, deserved success, will be inferred from the words in which Sir John Herschel indicates his own opinion of the value of her results. "To us," he says, "their evidence appears entitled to considerable weight; but it is more to our immediate purpose to notice the simple and rational manner in which her experiments were conducted, the absence of needless complication and refinement in their plan, and of unnecessary or costly apparatus in their execution, and the perfect freedom from all pretension or affected embarrassment in their statement."

In 1832 Mrs. Somerville published the work on which, in our opinion, her fame in future years will be held mainly to depend. The "Mechanism of the Heavens" was originally intended to form one of the works published by the Society for the Diffusion of Useful Knowledge, though it soon outgrew the dimensions suited for such a purpose. Indeed, it is remarkable that either Mrs. Somerville herself or Lord Brougham, at whose suggestion the work was undertaken, should suppose it possible to epitomise Laplace's *magnum opus*, or so to popularise it as to bring it within the scope of the Society's publications.

Mr. Proctor enters upon an elaborate criticism of this work, but we shall content ourselves with presenting our readers with the following extracts:—

It is in this sense—regarding the work apart from its special purpose, and judging of it only as a contribution to advanced scientific literature—that we may fairly say, with Sir John Herschel, that the work is one of which any geometer might be proud. There is, indeed, ample evidence of the disadvantage under which Mrs. Somerville laboured, in the want of thorough mathematical training; but so much the more wonderful is it that she should have completely mastered her subject. Every page indicates her appreciation of the methods employed by Laplace and Lagrange. Where she does not strictly follow the "Mécanique Céleste," she evidences a clear recognition of the purposes to be subserved by adopting a different course. I would not be understood as commending all the departures thus made; on the contrary, there are cases where it appears to me that on the whole it would have been preferable to have followed the processes of the "Mécanique Céleste" more closely, while there are others where certain more modern processes might perhaps with advantage have been introduced. But even in such instances we recognise in the course pursued by Mrs. Somerville the decision of one perfectly familiar with the subject in hand. And many of the changes must undoubtedly be regarded either as improvements, or else as altogether desirable when the scale of Mrs. Somerville's treatise is taken into account. Amongst instances of the former kind must be classed the method employed in the investigation of the equations of continuity of a fluid; amongst instances of the latter, I would specially cite the treatment of the theory of elliptic motion, in the opening chapters of the second book.

If, however, I were asked to point out the feature of this work which, in my opinion, most strikingly indicated the powers of Mrs. Somerville's mind, I should unhesitatingly select the preliminary dissertation. In this we have an abstract of the Newtonian philosophy such as none but a master mind could have produced. Apart from its scientific value—and it has great scientific value—it is a work of great literary merit. If it is not in plan and purpose altogether original, inasmuch as it must be regarded as to some degree an abstract of Laplace's "Sytème du Monde," it is nevertheless, as Herschel has well remarked, "an abstract so vivid and judicious as to have all the merit of originality, and such as could have been produced only by one accustomed to large and general views, as well as perfectly familiar with the particulars of the subject."

Three years after the appearance of the "Mechanism of the Heavens," Mrs. Somerville published the work by which she is probably best known to general readers. The "Connexion of the Physical Sciences" was, I believe, written at the suggestion of Lord Brougham, as an expansion of the admirable introduction to the "Celestial Mechanism." It is a work full of interest, not only to the student of advanced science, but to the general reader. In saying this we indicate its chief merit and its most marked defect. It is impossible to conceive that any reader, no matter how advanced or how limited his knowledge, could fail to find many most instructive pages in this work, but it is equally impossible to conceive that any one reader could find the whole work, or even any considerable portion, instructive or useful. The fact was that Mrs. Somerville recognized, or which is practically the same thing, wrote as if she recognized, no distinction between the recondite and the simple. She makes no more attempt at explanation when speaking of the perturbations of the planets or discussing the most profound problems of molecular physics, than when she is merely running over a series of statements respecting geographical or climatic relations. It would almost seem as though her mind was so constituted that the difficulties which ordinary minds expe-

rience in considering complex mathematical problems had no existence for her. A writer, to whom we owe one of the best obituary notices of Mrs. Somerville which hitherto have appeared, tells us that the sort of pressure Mrs. Somerville underwent from her publisher as the earlier editions of the "Connexion of the Physical Sciences" passed through the press "convinced her of her own unfitness for popularizing science. When there was already no time to lose in regard to her proof sheets, she had hint upon hint from Mr. Murray that this and that and the other paragraph required to be made plainer to popular comprehension. She declared that she tried very hard to please Mr. Murray and others who made the same complaint, but that every departure from scientific terms and formulas appeared to her a departure from clearness and simplicity; so that, by the time she had explained and described to the extent required, her statements seemed to her cumbrous and confused. In other words, this was not her proper work."

Respecting her two other works, I shall merely remark that the "Physical Geography" appeared in 1848, and the "Molecular and Microscopic Science" in 1869, when she had reached the advanced age of eighty-eight years.

After some further critiques, Mr. Proctor concludes the memoir thus, -

I have mentioned that Mrs. Somerville was twice married. By her first marriage she had one son, Mr. Woronzow Greig, since deceased. A few years after Captain Greig's death she married her cousin, Dr. Somerville, by which marriage she had three daughters, two of whom survive her. The latter years of her life (twenty-three years, we believe) were passed in Italy. It has been said by one who was well acquainted with the circumstances that "the long exile which occupied the latter portion of her life was a weary trial to her. She carried a thoroughly Scotch heart in her breast, and the true mountaineer's longing for her native country sickened many an hour of many a tedious year. She liked London life, too, and the equal intercourses which students like herself can there enjoy, whereas, in Italy, she was out of place. She seldom met any one with whom she could converse on the subjects which interested her most; and if she studied, it could be for no further end than her own gratification. It was felt by her friends to be a truly pathetic incident that, of all people in the world, Mrs. Somerville should be debarred the sight of the singular comet of 1843; and the circumstance was symbolical of the whole case of her exile. The only Italian observatory which afforded the necessary implements was in a Jesuit establishment, where no woman was allowed to pass the threshold. At the same hour her heart yearned towards her native Scotland, and her intellect hungered for the congenial intercourse of London, and she looked up at the sky with the mortifying knowledge of what was to be seen there but for the impediment which barred her access to the great telescope at hand. With all her gentleness of temper and her life-long habit of acquiescence, she suffered deeply, while many of her friends were indignant at the sacrifice."

I shall venture to quote, in conclusion, some remarks by Sir Henry Holland on features of Mrs. Somerville's character and life which have been hidden from general knowledge:—"She was a woman not of science only," he tells us, "but of refined and cultivated tastes. Her paintings and musical talents might well have won admiration, even had there been nothing else beyond them. Her classical attainments were considerable, derived probably from that early part of life when the gentle Mary Fairfax—gentle she must ever have been—was enriching her mind by quiet study in her Scotch home. . . . A few words more on the moral part of Mrs. Somerville's character; and here, too, I speak from intimate knowledge. She was the gentlest and kindest of human beings—qualities well attested even by her features and conversation, but expressed still more in all the habits of her domestic and social life. Her modesty and humility were as remarkable as those talents which they concealed from common observation. . . . . Scotland," he justly adds, "is proud of having produced a Crichton. She may be proud, also, in having given birthplace to Mary Somerville."

In the other pages of his work Mr. Proctor treats of the "Coming Transit of Venus, and British Preparations for Observing It," and to this he invites special attention, remarking that the time is drawing near when it will be too late to take action to extend and render complete and satisfactory our preparations for this important phenomenon - the most important, I venture to assert, of all the astronomical phenomena of the present century. Without imputing blame to any person, I must dwell strongly on the fact that the share proposed to be taken by Great Britain in the observations of the transit, is unworthy of her position in the scientific world, and as a nation. There is great risk that, for want of an adequate number of southern stations, the whole series of observations by all countries engaged in the work will result in failure; and it appears to me—nay, more positively it certainly is a deplorable circumstance, that while Russia and America are providing for more than thirty northern stations, whereof sixteen are Halleyan, Great Britain will supply but three southern stations, of which only one chances to be Halleyan as well as Delislean; while even as respects this one station, Mr. Goschen has told the country, speaking in his place in Parliament, that either Halley's method "will not be applied at all, or at least very little reliance will be placed upon it." Yet at sixteen northern stations, some of them most difficult of occupation, Russia and America will apply this very method; while even the criterion devised to minimize the value of the method, leaves it superior, when applied at the stations I have indicated, to Delisle's, as applied at selected station. Mr. Proctor adds:—I appeal to all who have influence in these matters to examine the evidence for themselves (whether as presented here, or with charts in my Essays in Astronomy, or in recent numbers of the Monthly Notices of the Astronomical Society), and to form their own judgment as to the position of affairs. That is all I ask, since I am satisfied that that will be altogether sufficient to suggest the promptest and most energetic action.

The other essays, all of them worthy of attentive perusal, are the Ever-Widening World of Stars, Movements in the Star-depths, the Great Nebula in Orion, the Sun's True Atmosphere, Something Wrong with the Sun, News from Herschel's Planet, the Two Comets of the Year 1868 (Part I.—Brorsen's Comet; Part II.—Winnecke's Comet), and Comets of Short Period. Followed by interesting observations on the Gulf Stream, Oceanic Circulation, and the Climate of Great Britain; the concluding essay being on the Low Barometer of the Antarctic Temperate Zone.

Six Lectures on Light.—Delivered in America in 1872-1873. By JOHN TYNDALL, LL.D., F.R.S., Professor of Natural Philosophy in the Royal Institution. London: Longmans, Green, and Co. 1873.

THE great number of works bearing on the various experimental sciences recently published would lead to the supposition that the means of scientific and technical instruction (which we still strive for having, and hope to see made available for various classes of the community, though more especially for the working classes) must soon become greatly in excess of the requirements of the case. But this is not so, for these works may be classed under two heads, those that survive only their first issue, which in a majority of cases are works of a very inferior and questionable character, likely to be more injurious than instructive, and those not over-numerous treatises that become reference-books for men of science, and text-books for the guidance of the young student anxious to obtain right and correct ideas of the various phenomena in connection with the different sciences. Amongst this latter class of works those of Professor Tyndall take a high position, for his previous works on the kindred sciences to that of the new work now under notice, namely, "Heat" and "Sound," have since their first issue a few years back, gone through many editions and been translated into the languages of other countries, where they are likewise regarded as standard works. The particular work under notice does not reach that order of merit which we should have expected of him in order to rank with the latest editions of his previous volumes, neither can we say that there is any more contained in it than we have read in other works before. True, Professor Tyndall surpasses most authors of works on science in the lucid descriptive manner of placing facts before his readers; but we could point to one or two recent works on the same subject that to our thinking surpass this work in point of excellence in that respect; but it must be remembered that this work is the substance of lectures given before various audiences, and that, therefore, original research could not reasonably be expected. But there is, we think, another cause for this, for there seems to us to be a lack of illustrations to explain the various phenomena contained in this book. The following is a brief *résumé* of the contents of this work:—The first lecture begins with the various notions entertained as regards light by the ancients, and then proceeds with the account of the discovery by Roemer, the Danish astronomer, of its velocity, afterwards confirmed by the researches of the astronomer of our own country Bradley—the refraction and reflection of light, and the composition of solar light and its analysis by Sir Isaac Newton. We extract the account of this remarkable discovery as given by Prof. Tyndall:—

He (Newton) went to work in this way: Through the closed window-shutter of a room he pierced an orifice, and allowed a thin sunbeam to pass through it. The beam stamped a round white image of the sun on the opposite wall of the room. In the path of this beam Newton placed a prism, expecting to see the beam refracted, but also expecting to see the image of the sun, after refraction, round. To his astonishment, it was drawn out to an image with a length five times its breadth. It was, moreover, no longer white, but divided into bands of different colours. Newton saw immediately that solar light was composite, not simple. His elongated image revealed to him the fact that some constituents of the light were more deflected by the prism than others, and he concluded, therefore, that white solar light was a mixture of lights of different colours and of different degrees of refrangibility.

To the end of the first lecture the subject of solar light and its composition is gone into.

In the second lecture, the theories as regards the propagation of light are discussed—the emission theory, and undulatory or wave theory—the latter one being now generally accepted as the true one. This remarkable theory was first given to the world by Dr. Thomas Young, and for which he was most unjustly ridiculed by one who eventually became Lord Chancellor of England.

The following gives an account of this great man, and an estimate of his work :—

In the year 1773 was born, at Milverton, in Somersetshire, one of the most remarkable men that England ever produced. He was educated for the profession of a physician, but was too strong to be tied down to professional routine. He devoted himself to the study of natural philosophy, and became in all its departments a master. He was also a master of letters. Languages, ancient and modern, were housed within his brain, and, to use the words of the epithet, "he first penetrated the obscurity which had veiled for ages the hieroglyphics of Egypt." It fell to the lot of this man to discover facts in optics which Newton's theory was incompetent to explain, and his mind roamed in search of a sufficient theory. He had made himself acquainted with all the phenomena of wave-motion; with all the phenomena of sound; working successfully in this domain as an original discoverer. Thus informed and disciplined, he was prepared to detect any resemblance which might reveal itself between the phenomena of light and those of wave-motion. Such resemblances he did detect; and, spurred on by the discovery, he pursued his speculations and his experiments, until he finally succeeded in placing on an immovable basis the undulatory theory of light.

The founder of this great theory was Thomas Young, a name, perhaps, unfamiliar to many of you, but which ought to be familiar to you all. Permit me, therefore, by a kind of geometrical construction which I once ventured to employ in London, to give you a notion of the magnitude of this man. Let Newton stand erect in his age, and Young in his. Draw a straight line from Newton to Young, tangent to the heads of both. This line would slope downwards from Newton to Young, because Newton was certainly the taller man of the two. But the slope would not be steep, for the difference of stature was not excessive. The line would form what engineers call a gentle gradient from Newton to Young. Place underneath this line the biggest man born in the interval between both. It may be doubted whether he would reach the line; for if he did he would be taller intellectually than Young, and there was probably none taller. But I do not want you to rest on English estimates of Young; the German, Helmholtz, a kindred genius, thus speaks of him: "He was one of the most profound minds that the world has ever seen; but he had the misfortune to be too much in advance of his age. He excited the wonder of his contemporaries, who, however, were unable to follow him to the heights at which his daring intellect was accustomed to soar. His most important ideas lay, therefore, buried and forgotten in the folios of the Royal Society, until a new generation gradually and painfully made the same discoveries, and proved the exactness of his assertions and the truth of his demonstrations."

It is quite true, as Helmholtz says, that Young was in advance of his age; but something is to be added which illustrates the responsibility of our public writers. For twenty years this man of genius was quenched—hidden from the appreciative intellect of his countrymen—deemed in fact a dreamer, through the vigorous sarcasm of a writer who had then possession of the public ear, and who in the *Edinburgh Review* poured ridicule upon Young and his speculations. To the celebrated Frenchmen, Fresnel and Arago, he was first indebted for the restitution of his rights, for they, especially Fresnel, remade independently, as Helmholtz says, and vastly extended his discoveries. To the students of his works Young has long since appeared in his true light; but these twenty blank years pushed him from the public mind, which became in turn filled with the fame of Young's colleague at the Royal Institution, Davy, and afterwards with the fame of Faraday. Carlyle refers to a remark of Novalis, that a man's self-trust is enormously increased the moment he finds that others believe in him. If the opposite remark be true—if it be a fact that public disbelief weakens a man's force—there is no calculating the amount of damage these twenty years of neglect may have done to Young's productiveness as an investigator. It remains to be stated that his assailant was Mr. Henry Brougham, afterwards Lord Chancellor of England.

The third lecture treats of the effect of crystallization upon optical phenomena, and also of the polarization of light is gone into; and in the fourth, polarization is still more widely discussed, on, the chromatic phenomena produced by the action of crystals and double refracting bodies on polarized light is examined. Professor Tyndall, at the end of this lecture, thus sums up the changes on clouds that polarization undergoes from its first appearance on the barely visible blue to its final extinction in the coarse cloud :—

1. The actinic cloud, so long as it continues blue, discharges polarized light in all directions, but the direction of maximum polarization, like that of sky-light, is at right angles to the direction of the illuminating beam.

2. As long as the cloud remains distinctly blue the light discharged from it at right angles to the illuminating beam is perfectly polarized. It may be utterly quenched by a Nicol's prism, the cloud from which it issues being caused to disappear. Any deviation from the perpendicular enables a portion of the light to get through the prism.

3. The direction of vibration of the polarized light is at right angles to the illuminating beam. Hence a plate of tourmaline, with its axis parallel to the beam, stops the light, and with the axis parallel to the beam transmits the light.

4. A plate of selenite placed between the Nicol and the actinic cloud shows the colours of polarized light, in fact, the cloud itself plays the part of a polarizing Nicol.

5. The particles of the blue cloud are immeasurably small, but they grow gradually in size, and at a certain period of their growth cease to discharge perfectly polarized light. For some time afterwards the light that reaches the eye through the Nicol is of a magnificent blue, far exceeding in depth and purity that of the purest sky; thus the waves that first feel the influence of size at both limits of the polarization are the shortest waves of the spectrum. These are the first to accept polarization, and they are the first to escape from it.

The fifth lecture proceeds to the question of fluorescence and also the identity between light and heat. And in the sixth and final lecture, that most interesting subject, spectrum analysis, is explained, and its application to determining the different constituents, —both mineral and gaseous—of the vast universe around us; also those of our own globe.

At the end of this lecture a very complete and interesting summary of the whole of the lectures is given.

Notwithstanding such minor objections to this work as we have already detailed, we cordially recommend it to our readers, and more particularly to those studying physical science.

The Geological Evidences of the Antiquity of Man, &c., by Sir Charles Lyell, Bart., M.A., F.R.S., &c. Fourth Edition Revised. Illustrated by Woodcuts. London: John Murray, Albemarle-street, 1873.

This fourth edition of Sir Chas. Lyell's celebrated work brings the treatment of the subject-matter of its pages into accord with recent discoveries, and we know of no better way of giving a general notion of the contents of this new edition than quoting from its preface.

A space of ten years, Sir Charles observes, has now elapsed since the publication of the third edition, during which time I have been occupied with two editions of the "Principles of Geology," and two editions of the "Elements of Geology," in which I have embodied incidentally many of the daily accumulating proofs of man's antiquity. A fourth edition of this work has now long been called for, and I have therefore carefully revised it and introduced such new matter as seemed to me necessary to bring it up to the present state of our knowledge.

Finding that many persons have failed to recognise the natural connection of the three separate parts of this work, I have now placed them under three distinct titles, the first of which, called the "Antiquity of Man," might with more propriety have been distinguished as the "Geological Memorials of Man."

The second part on the Glacial Period, which was formerly the subject of much criticism, will no longer be regarded as irrelevant to the main subject of man's antiquity now that so much discussion is going on whether man is pre-glacial or post glacial.

The third part, treating of the origin of species with reference to man's place in nature, has too evident a bearing on the preceding parts to need any special comment.

Among other corrections and improvements made in the present edition, I may mention—

1st. That in the earlier chapters I have profited in many places by the works of Sir John Lubbock on "Pre-historic Man," and that of Mr. John Evans on "Ancient Stone Implements."

2ndly. I have reconsidered the question of the rise of land in Scotland, and have brought forward the many facts which lead me to conclude that the opinion I formerly adopted, on the evidence of Mr. Geikie, that there had been a rise of twenty-five feet in Post-Roman times, is no longer tenable.

3rdly. I have added an account of the exploration of the caverns of the Lesse in Belgium by M. Dupont, and some interesting conclusions which he has drawn from them.

4thly. I have completely recast the chapter relating to Brixham Cavern and Kent's Hole, and have added some new information respecting the age of the deposits in the latter cavern.

5thly. In the spring of 1872 I visited the cave of Aurignac with my friend Mr. T. McK. Hughes, now Woodwardian Professor at Cambridge, and we convinced ourselves that the geological proofs of the remoteness of the era to which the existence of sepulchral rites may be carried back are more doubtful than M. Lartet and I had formerly supposed.

6thly. At the same time I visited with Mr. Hughes the caverns of the Dordogne of which, together with the carvings contained in them, I have given some account.

7thly. I have also given a description of a skeleton found by M. Rivière in a cave at Mentone, which, from the unpolished implements and extinct animals associated with it, I am inclined to consider as of Paleolithic age. Since the sheets were printed, a second skeleton has been brought to light by M. Rivière in a neighbouring cavern under similar conditions. He informs me in a letter (April 17, 1873) that he found with this second human fossil a flint lance and flint hatchet, both unpolished. Around the arms, wrists, and knees were bracelets of Mediterranean shells, Nassa, Cypræa, and Buccinum; and the skeleton and surrounding earth were stained red by oxide of iron, as was the case with the skeleton discovered in 1872. Extinct animals were found also at a higher level than this second skeleton, but I infer from letters received from Mr. Charles Moore, now at Mentone, that the time of

inhumation of these remains of elephant, rhinoceros, and cave-bear in subaerial breccias at different attitudes in the cliffs will have to be critically ascertained before their geological bearing on the age of the human skeletons can be finally settled.

8thly. In Part II., in dealing with the period immediately preceding that in which we have positive traces of man, I have found it necessary entirely to recast the twelfth chapter relating to the crags of Norfolk and Suffolk, and have taken the opportunity of adding new information from the recent memoirs of Mr. Prestwich, aided by Mr. Gwyn Jeffreys, and those of MM. Searles Wood, sen., S. Wood, jun., and Harmer (Chapter XII.)

9thly. In regard to the question of re-action in the Glacial Period, both in the British Islands and in the Alps and elsewhere, I have discussed the merits of the rival theories proposed to account for the transportation of erratic blocks and the erosion of lake-basins, and have added some new facts respecting the continental ice of Greenland derived from the observations of MM. Nordenskiold and Richard Brown (Chapters XIII to XV.)

10thly. In the recapitulation of the proofs of man's antiquity, I have dwelt more fully than in former editions the remote dates of civilization afforded us by the monuments and traditions of Egypt and other Oriental countries.

11thly. In Part III. I have been enabled to make one very important addition. At the time when the third edition of this work was published, the absence of intermediate links was one of the greatest difficulties experienced by the advocates of transmutation. Since then, three intermediate fossil forms have been discovered, linking together the two classes, Aves and Reptilia, and among the Mammalia, two extremely ancient and less specialised forms of the horse have been found in the Upper and Lower Miocene formations, affording evidences of the gradual modification of this animal from a different ancestral type.

12thly. In the concluding chapter on the theory of transmutation as applied to man I have considered the bearing of some of the new facts and conclusions in Mr. Darwin's "Descent of Man," and in reference to the origin of races, that of the Greeks in particular, I have considered Mr. Francis Galton's speculations on the causes of their pre-eminence as treated of in his book on "Hereditary Genius."

The following is a list of the dates of publication of successive editions of the "Antiquity of Man," and other geological works of intermediate date—

Antiquity of Man, 1st edition	Feb. 1863
Antiquity of Man, 2nd edition	April 1863
Antiquity of Man, 3rd edition	Nov. 1863
Elements of Geology, 6th edition	1865
Principles of Geology, 10th edition . .	1866-68
Student's Elements of Geology	1871
Principles of Geology, 11th edition	1872
Antiquity of Man, 4th edition	May 1873

We scarcely need to add that the body of the work is thoroughly consonant with these prefatory statements.

The Chemistry of Sulphuric Acid Manufacture. By Henry Arthur Smith. London: E. and F. N. Spon, 48, Charing Cross.

This is a useful practical treatise, that may fairly be considered as a considerable addition to the aids to real technical education, being on a subject of great importance to our national industries, in many of which sulphuric acid sustains no inconsiderable part. The work commences with some historical remarks showing that it is probable that sulphuric acid was discovered in the year 806 by Rhazes, a physician in Bagdad, and not, as has been often stated, by Basil Valentine; but to quote from the work before us:—

This point, however, must be left to others more competent than myself to judge of it. One thing, however, seems certain, that it was first prepared by the distillation of sulphate of iron—green vitriol. This substance, when submitted to a high temperature, yields a mixture of sulphuric and sulphurous acids, the sulphuric acid thus obtained receiving the name of "Nordhausen sulphuric acid," from the name of the place where, at the present day, this manufacture is still conducted by the distillation of the sulphate of iron.

As time wore on, however, and other manufactures became more extensive, this acid was required in much larger quantities and on a less expensive scale. It is to Dr. Roebuck, of Birmingham, that we owe the method at present employed, and which, since its introduction, has undergone comparatively little change. The changes that have been made have principally tended towards the removal of practical difficulties, whilst the principle involved in the original process remains the same.

Sulphuric acid manufacture, as carried on at the present day, may be divided into three parts.

1. Burning sulphur or a sulphur ore in furnaces, or, as they are technically called, "kilns."

2. A large chamber in which the condensation of the acid takes place, formed of sheets of lead.

3. The necessary supply of air, of gaseous nitric acid and steam.

When sulphur is ignited in a current of air it volatilizes, and, robbing the air of part of its oxygen, becomes converted into sulphurous acid (SO_2). This sulphurous acid, which, in its original condition, is in the form of gas, passes from the kilns by means of a flue, enters the lead chamber (No. 2 above), where, on coming in contact with the gaseous nitric acid and steam, it becomes converted into sulphuric acid at the expense of part of the oxygen of the nitric acid gas, which becomes converted into nitric oxide; this, in its turn, seizes the oxygen present in the air, and returns to its original condition.

This, as may be seen from the description, is a continuous process. And theoretically, although we find not so practically, a small amount of nitric acid is able to convert an unlimited amount of sulphurous acid into sulphuric acid, whilst the steam which is present in the chamber merely acts as a carrier of oxygen from the air to the nitric oxide.

The lead chamber, in which the condensation takes place, is built of numerous separate sheets of lead, soldered together at the edges by means of the hot flame of burning hydrogen, thus omitting the use of any substance which would be liable to be acted upon by the chamber gases, or by the acid itself. This large continuous chamber is generally about 100 feet long by 20 feet high and 30 wide. The size, however, depends entirely upon the views of the manufacturer.

This, then, is the rationale of sulphuric acid manufacture, seemingly a simple and straightforward process enough, but one which in reality requires very great care and attention.

Mr. Smith, in the following pages, details the process adopted in obtaining sulphuric acid from pyrites, as in this, as he says, is naturally included that made from pure sulphur. The presence of arsenic is the great difficulty in operating upon pyrites to obtain sulphuric acid, and a large portion of the work is, therefore, devoted to that question.

The principal member of the sulphuric acid apparatus is the leaden chamber, to which Mr. Smith devotes many pages of his work. The following extract will afford our readers a fair sample of the nature of the information conveyed in this little work:—

AN INQUIRY INTO THE BEST FORM OF LEADEN CHAMBER.

The introduction of the leaden chamber into the manufacture of sulphuric acid must be ascribed to Dr. Roebuck, of Birmingham; and the principle of the method employed by him continues as the principle of that in use at the present day.

A mixture of sulphur and nitre mixed in certain proportions was ignited and shut into an air-tight lead chamber, the side of which varied from 6 to 10 feet in diameter; after a certain time had elapsed—supposed to have been sufficient to have condensed all the acid formed by the burning sulphur—the chamber was opened, the stand and vessel in which the mixed substances were placed was withdrawn, refilled with the mixture, and again inserted into the chamber, the door of which was then luted on air-tight, as before. This, then, was the rough-and-ready manner in which sulphuric acid was manufactured in this country in the days of the first lead chambers. This was the small cloud rising in the horizon which we, in our day, look back upon with a mixture of amusement and wonder. Once a beginning was made, it was easy enough to proceed, and the first step had been taken.

The obvious disadvantage in this plan was the discontinuity of the process. Each time the chamber was opened the residual gases—those which had not undergone condensation—escaped, whilst the chamber was lying idle till a fresh charge was introduced. This difficulty was overcome by the substituting for the small vessels which were being continually inserted and withdrawn, larger boilers in which the sulphur was burned, thus sending a continuous stream of sulphurous acid into the chamber; then came the introduction of steam by Kestner; and by slow degrees the great manufacture which at the present day contributes so much to the great wealth of England sprung up.

This chamber, then, is the point upon which the attention is, naturally, most concentrated. In this all the actions take place, and the nature of the work it performs, and the manner in which it performs it, are very imperfectly understood.

In the preceding pages I have shown, although imperfectly, the conditions under which this chamber does its best work; and I now intend, in a very brief manner, to inquire into the best form of chamber, which, it seems to me, is indicated by the preceding observations. By referring to pages 34-37 it will be seen that the sulphurous acid, after entering the chamber at one end, becomes almost immediately acted upon by the steam and nitric acid with which it comes in contact; that the action between the gases is very trifling towards the top of the chamber, the greatest amount of action being at the bottom. This leads me to the conclusion that the upper portion of the chamber acts merely as a reservoir for the gases, which it supplies, as they are wanted, to the lower portions, where the conditions are more favourable to the formation of acid.

If, now, instead of using the chambers as at present employed, the height were to be lessened, there would then be a much greater condensing surface than in the present form. And here I should just like to say a word respecting condensing surface. It seems to be tacitly admitted among the greater proportion of sulphuric acid manufacturers that the one thing needful for complete condensation is "condensing space;" and "condensing space" and "condensing surface" are often, indeed generally, used as synonymous terms. I have shown that very little, if any, action takes place where there is no "surface;" the presence of some tangible substance seems to influence in some indirect way the action of the gases upon each other. This also seems to be the common-sense view to take; but even among thoroughly

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THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON.

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Past Presidents.

SIR DAVID BREWSTER K.H, LL.D, F R S, &c, from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868

LORD RICHARD GROSVENOR, M P

Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES.

COUNCIL MEETING, THURSDAY, AUGUST 14th

(7 o'clock),

At the Office of "The Scientific and Literary Review, 21, Cockspur Street

All Subscriptions should be paid to Mr. G A SPRETTON, the Receiver, 4, St. Martin's-place, S W

The Inventors' Institute.

A MEETING of members of the Institute was held on the 10th July for the purpose of conferring on the subject of the Patent Law, when Mr. F. H. VARLEY, vice-chairman of the ordinary council took the chair.

Mr. CAMPIN (the secretary) opened the proceedings by stating that the present meeting, which was one outside the ordinary limits of the session, had been called together in order that the members might have an opportunity, before the close of the present sitting of Parliament, to say whether they would advise any action being taken on the subject of the Patent Laws, or whether, considering the present state of political matters, and the fact that the Government showed no signs of taking any Parliamentary action on that question, the Institute should abstain from moving in it. For his part he would say that he thought it would be mere waste of time to take any steps in the matter. Independently of the question of Parliamentary action, however, was one on which some further steps should be taken by the Institute. He alluded to the International Patent Law Congress at Vienna. They were doubtless aware that Dr. Collyer had been commissioned to act as their honorary commissioner at the Congress; but the Institute had not given him any specific instructions as to the line of action it wished him to take. No doubt Dr. Collyer was so well acquainted with their views and wishes that he would take the position of a faithful and efficient advocate, still the Institute might consider it proper to give him some definite instructions.

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Monthly Notices.

The past month has been noteworthy in several respects. Mr. Henry Cole, C.B., having resigned his post at South Kensington, has been the subject of testimonializing. We have so often found fault with the proceedings of this gentleman that we cannot rank ourselves as amongst those who regret his departure from office. We trust his successor will be a man who will emulate all that was good in Mr. Cole, and avoid all that was otherwise. However, Mr. Cole's services as a promoter of Public Education in Art and Science, we think no one who visits South Kensington, and knows or inquires into its history, will have the hardihood to deny. We have no wish to do so; doubtless there is something to be said for the claims of Mr. Scott Russell, Mr. Fuller, and others, as helping on the movement which culminated in South Kensington. But, what man knowing anything of Governments in general, that gigantic and apathetic animal, the Public, and our own Government in particular, can fail to see that Mr. Cole's life has been spent in doing much hard work, and that this work has produced a beneficial change in our governmental action regarding education, and has undoubtedly improved the public taste; therefore, in these days of testimonials there seems no good reason why Mr. Henry Cole should not get one worth having.

The meeting at Marlborough House of H.R.H. the Prince of Wales, the Lord Mayor and members of the City Guilds, in regard to technical education, is a matter of great importance; but these guilds will have to be cautious. Behind the Prince of Wales are the authorities of South Kensington Museum, and they are quite capable of "putting the guilds into their pockets" in this matter

During the month two eminent men, the Bishop of Winchester (Wilberforce), and Lord Westbury (Bethell) have died.

The new Atlantic Cable has been successfully laid. It is said we are to have one of Mr Highton's (member of the Inventors' Institute) light cables. It will cost, it is estimated, somewhere under £100,000, and, if it succeeds, the charge for telegrams to America will be considerably reduced. We must say that if a cable such as the one mentioned could be made for such a sum of money, it is well worth trying.

The Council of the Institution of Civil Engineers have awarded the following Premiums:—Watt Medals and Telford Premiums, to Sir C. A. Hartley, M Inst. C.E., for his paper "On the Delta of the Danube, and the Provisional Works executed at the Sulina Mouth;" to J. Head, Assoc. Inst. C.E., for his paper "On the Rise and Progress of Steam Locomotion on Common Roads," to W. Anderson, M Inst. C.E, for his description of "The Aba el Wakf Sugar Factory, Upper Egypt." Telford Medals and Telford Premiums, to J. Deas, M. Inst. C.E., for his memoir "On the River Clyde;" to W. C. Thornton, C B, for his essay "On the Relative Advantages of the 5 Feet 6 Inches Gauge, and of the Metre Gauge for the State Railways of India," to Col. W H. Greathed, C B., R.E, for his "Account of the Practice and Results of Irrigation in Northern India" Telford Premiums, to J. Milroy, Assoc. Inst. C.E., for his paper "On Cylindrical or Columnar Foundations in Concrete, Brickwork, and Stonework;" and to W. Pole, LL.D., F R.S, M. Inst. C E, for his "Notes on the Rigi Railway."

The Académie des Sciences has elected Sir Charles Wheatstone as an associate of the Academy The election is, however, subject to the approval of the President of the French Republic.

At the annual meeting of the South Midland Institute of Engineers, at Wolverhampton, on Monday, June 30th, Mr. Edward Jones showed samples of coal and shale that had been found in sinkings, which he was conducting for the Duke of Sutherland, at Brora, in Sutherlandshire. He added to the interest of the meeting by describing the results of his recent explorations in this Oolitic coal-field. We cannot but regret that Mr. E. Jones should have described his researches as resulting in a discovery. The Rev. Dr. Buckland and Sir C. Lyell visited Brora in 1824, and stated "that the strata there were wholly unconnected with the proper coal formation below the New Red Sandstone, and were, in fact, the equivalent of the Oolitic series." Sir R. Murchison also visited Brora in 1827, and confirmed the views of his brother geologists in a paper published in the *Geological Transactions* for that year. The fact that the sinkings now made are at some distance from the old ones does not in the least alter the geological question.

News has again arrived from America by cable of the discovery of another new small planet (No. 132), on June 13.

The Miners' Association of Cornwall and Devon has just issued its reports and proceedings for 1872-3. This association, which was founded by Mr. Robert Hunt in October, 1859, has been steadily and quietly pursuing its purpose of giving instruction in science to the miners of Western England. In its classes during the past year upwards of one hundred students have received instruction in chemistry, mineralogy, and geology, and the results, as shown in the examinations by the Department of Science and Art, are most satisfactory.

We learn from the *Chemical News* that the President of the Duchy of Hesse Nassau presented Prof. Fresenius, in the name of the Emperor, with the Gold Medal for Science. The Imperial Prince and Princess, with an autograph letter, conveyed to him a laurel wreath, while his pupils presented him several handsome gifts; the ceremonials of the day finishing with a dinner, at which more than two hundred friends and students sat down.

The sun's surface was scrutinised at the Leipzig Observatory, in the year 1872, on 198 days. On not one of those days was it destitute of spots; usually the number seen was considerable. On July 13, 65 spots were seen, divided into 10 groups; and on the four days immediately preceding this, the least number of spots was 45, and the smallest number of groups 10.

The last number of Petermann's *Mittheilungen* opens with an article by Capt. A. Niemann, "On the Russian Expedition to Khiva," illustrated by a couple of neat little maps.

The quarterly Weather Report of the Meteorological Office, Part 3, July-September, 1871, is noteworthy since, with it, we receive the Monthly Record of Observations taken at the Melbourne Observatory for February, 1873. The first is nearly two years behindhand, the second is only four months, and comes to us from our Antipodes.

A microscopic study of the crystalline rock—especially porphyrites—occurring in the valley of the Nahe, a tributary of the Rhine, has been undertaken by Prof. A. Streng, of Giessen; and the result of his studies appear in the last number of Leonhard and Geinitz's *Jahrbuch fur Mineralogie*, &c.

The last number of Siebold and Kolliker's *Zeitschrift fur Wissenschaftliche Zoologie* contains an interesting paper, by Dr. Carl Kraepelin, on the Structure, Mechanism, and Development of the Sting in Bees and other Hymenopterous Insects. The same number contains, among other papers of interest, one by Dr. Nitsche, on the Structure of the Head of the Tapeworm.

The *Bulletin de la Société Impériale des Naturaliste de Moscou*, No. 4, for 1872, contains an important paper, with three plates, by M. Pierre Mayewski, entitled "Evolution des Barbules du *Begonia Manicata*," and a valuable set of meteorological observations made "à l'Institut des Arpenteurs (dit Constantin) de Moscou," during 1872, communicated by M. J. Weinberg.

The *Revue Universelle des Mines et de Métallurgie* for January and February, 1873, contains a paper of upwards of one hundred pages, by M. Jules Havrez, called a "Notice sur les Progrés realisés dans les Engins d'Extraction," illustrated by a set of well-executed plates.

The Annales des Mines, the first part for 1873, gives an interesting series of researches by M. de Gouvenain, upon the chemical composition of the thermo-mineral waters of Vichy, of Bourbon-L'Archamqault, and of Neris. The most remarkable point is the notable proportion of flour discovered; the following being the quantities found in each litre:—In the waters of Vichy, nearly 8 milligr.; of Bourbon-L'Archambault, 3; and of Neris, 6. In this journal, under the head of "Législation Anglaise," the two new Acts of Parliament for the regulation of coal and metal mines have been translated into French.

M. Cazalis de Fondouce has published a quarto monograph, "On the Allés Convertes de la Provence." He believes that these pre-historic stone monuments were constructed by a race related to the Ligurians.

Electricians will be interested in a paper by Herr F. Kohlrausch, "On the Reduction of the Siemens-Unit of Electrical Resistance to Absolute Measure." This paper appears in a recent number of Poggendorff's *Annalen*, where will be also found a long memoir by Dr. Schneebeli, entitled "Beitrage zur Kenntnis des Stabmagnetismus." The same number contains three papers by Herr H. Schroder, "On the Volumetric Constitution of Solid Bodies."—*Extract from Athenæum.*

THE INVENTORS' INSTITUTE

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Mr. Blanchett said he would suggest that as he found, from the public journals, that written communications would be received by the Congress, that notwithstanding Dr. Collyer's appointment, the Invention Right Bill, prepared by the Institute, should be sent to it with suggestions that it was considered by the members that that Bill was a good basis for legislation.

Mr. Cressey seconded this proposition, which was put to the meeting and carried unanimously.

The Chairman then remarked that Mr. Blanchett had brought into the room a model of an apparatus for indicating to the passengers in railway carriages the name of the station they were about to arrive at, and he wished to exhibit it to the meeting, and obtain opinions on its practicability and novelty. This model was exhibited, and various suggestions were made by members present, the result being that although some modifications of details might be needed, yet it was, on the whole, an invention of practical value. The meeting then closed with a vote of thanks to the chairman.

An ordinary meeting of the Council was held previously to the above meeting, Mr. F. H. Varley, vice-chairman of the ordinary council, presiding, when it was resolved:—"That an appeal be made to the members of the Institute to pay, at an early date, all subscriptions now due in order to increase the available funds of the Institute, so that the council may be able to carry out the various important matters requiring immediate attention." Also:—"That Mr. Thomas Morgan, Secretary of the Inventors' Patent-right Association, be, and is hereby, elected a member of this council." Resolved:—"That this meeting be adjourned to Thursday, the 24th inst., at 7 o'clock p.m., to meet at the office of the Scientific Review, 21, Cockspur-street, S.W. Messrs. James Nicholas Douglas (Member of the Institution of Civil Engineers), Rev. Thomas Jones, and John Wyatt having been admitted members of the Institute, were ordered to be entered on the list of members.

On the 24th July another council meeting was held, at which the measures for giving practical effect to the resolutions passed at the meeting on the 10th inst. were duly considered, and Messrs. Henry Skoines, Jonathan Newall, Alex. McLeith, W. H. Baxter, G. F. L. Meakin, Charles Hyde, William Bates, and Thomas Black having been admitted members of the Institute, were ordered to be entered on the list of members.

A communication was laid before the Council from Mr. Ludwig Mond, forwarding tickets of admission to the International Patent Congress in Vienna. It was ordered that measures be taken for giving publicity to the fact that the Secretary had such tickets for distribution. Propositions as to the election on the council of Messrs. D. J. McLauchlan, W. Hempson Durham, and Berger Spence were passed unanimously.

Royal Polytechnic Institution, (Thursday, 26th June, 1873).—In his lecture on ice and refrigerators, Professor Gardner demonstrates the practical process of refrigerating and ice making, which have now arrived at such a pitch of excellence that ice is no longer only a luxury or a medical remedy but one of our necessary comforts. Great attention has been paid to this part of domestic art and science within our memory, and, during the past 20 years, many very clever plans have been invented for making ice. Since Leslie showed in his then novel experiments that water could be frozen by its own evaporation, a continuous series of improvements have been made. Ice is now made in large quantities by the evaporation of ether—by the evaporation of ammonia—by the expansion of air which has been previously greatly condensed and cooled before it is allowed to again expand. This plan is now brought to a great state of perfection by injecting water with the condensed air so as to absorb the heat. This the water, owing to its great capacity for heat, does most effectually. In breweries these plans are employed for "wort cooling." For domestic and household purposes we take advantage of the cold produced during the solution of various chemical substances, as in Kent's patent dinner ice maker, a clever adaptation of this principle. The process of refrigerating by ice safes is now extensively employed; a perfect safe would solve at once the difficulty of our meat supply, and the transport of foreign abundance to meet home scarcity would be easily accomplished. An ice safe is often represented by the rough and crude notion which too often presents itself in a box with two lids containing a lump of ice; against this very unscientific arrangement many objections are urged. Some improvements have been made, the most prominent is the so-called ventilation safes. This plan, to be successful, must be carried out on scientific principles, or it is a delusion and a snare, leading to waste of ice, the motive power of the machine, and to the more rapid decay of the perishable contents of the safe. An ingenious improvement, and at the same time a most simple one, is exhibited in the patent safe arranged upon a plan suggested and carried out by Mr. Kent, which brings the air to ventilate the safe in at the top and directly in contact with the ice contained in an ice box at the top of the safe: the air must by this plan pass through the body of the ice and be brought to a temperature of 32° F., or the freezing point, before it enters the safe or comes in contact with the substances contained therein. By this plan, a great result is, it seems, obtained in the length of time fish, cream, game, &c., can be preserved. It is evident that air at the freezing point would be deprived of any living organisms, because, at 32°, they would be deprived of vitality; and it is a fact well known to chemists and philosophers that water at 32° greedily seizes upon and dissolves any impure gases present in the air. These facts reasonably explain the benefits derived from this simple arrangement.

Proceedings of Societies.

ROYAL SOCIETY.

JUNE 19TH, 1873.—W. Spottiswoode, Treas. and V.P., in the chair. A number of papers were read, and the Society adjourned over the long vacation, to Thursday, November 20.

ASTRONOMICAL SOCIETY.

JUNE 13TH, 1873.—Professor Cayley, President, in the chair. Mr. J. J. Lambert was elected a Fellow. The following communications were announced, and partly read: "On the Motion of Equatorials in R.A.," by Mr. Erck,—"On the Appearance of Jupiter's Fourth Satellite in Transit," by Mr. Burton,—"Elements and Ephemeris of Temple's Comet," by Mr. Hind,—"On a possible Lunar Atmosphere," by Mr. Meison,—"Observations of Venus," by Mr. Langden,—"On the Total Solar Eclipse of June 14, 2151," by Mr. Maguire,—"On the Disappearance of the Coloured Equatorial Belt of Jupiter," by Mr. Browning,—"Coordinates of Stars in or near the Milky Way," and "Elements of the Five Minor Satellites of Saturn," by Mr. Marth,—"Notes on Mars," by Mr. Knobel—"Observations of Solar Eclipse of May 25," by Capt. Noble,—"Clock by Franklin," by Mr. Lecky,—"Partial Solar Eclipse, May 25," by Mr. Perry,—"Observations of Temple's Comet," by Sir G. B. Airy,—"Discovery of Minor Planet 131," by Mr. Dunkin,—"Occultations of Stars by the Moon, and Eclipses of Jupiter's Satellites," by Rev. R. Main,—"On Dr. Oudeman's Photographs of Solar Eclipse of December, 1871," by Col. Tennant,—"Determination of Longitudes by Moon Culminations," by Dr. Hull,—"On the Mass of Jupiter," by Mr. Lynn,—"On two Telescopic Meteors," and "On a Recording Micrometer," by Mr. Christie,—"On Sympathetic Influence between Clocks," by Mr. Ellis,—"On the Determination of Solar Parallax by Observations of Flora," by Mr. Galle,—and "Stereographic Projection of Transit of Venus, in 1882," by Mr. Proctor.

GEOLOGICAL SOCIETY

JUNE 11TH, 1873.—Professor Ramsay, V.P., in the chair.—The following communications were read: "On the Nature and probable Origin of the superficial Deposits in the Valleys and Deserts of Central Persia," by Mr. W. T. Blanford.—"On *Caryophyllia Bredai*, Milne-Edwards and Haime, from the Red Crag of Woodbridge," by Professor P. M. Duncan,—"On the Cephalopoda-Bed and the Oolite Sands of Dorset and Part of Somerset," by Mr. J. Buckman,—and "On *Cetarthrosaurus Walkeri* (Seeley), an Ichthyosaurian from the Cambridge Upper Greensand," by Mr. H. G. Seeley.

June 25th.—J. Prestwich, Esq., V.P., in the chair.—T. Douglas, J. Mitchell, jun., R. Botley, D. Ruddle, J. Dunning, T. Stephens, and J. Willis, were elected Fellows. The following communications were read:—"On Six Lake-basins in Argyllshire," by the Duke of Argyll, President; "Description of the Skull of a dentigerous Bird (*Odontopteryx toliapicus*, Owen), from the London Clay of Sheppey," by Prof. R. Owen; "Contribution to the Anatomy of *Hypsilophodon Foxii*, an Account of some recently acquired Remains of this Dinosaur," by Mr. J. W. Hulke; "On the Glacial Phenomena of the 'Long Island,' or Outer Hebrides," by Mr. J. Geikie (First Paper); "Notes on the Glacial Phenomena of the Hebrides," by Mr. J. F. Campbell; "On Fossil Corals from the Eocene Formation of the West Indies," by Prof. P. Martin Duncan; and "Note on the Lignite-Deposit of Lal-Lal, Victoria, Australia," by Mr. R. Etheridge, jun. The next meeting of the society will be held on Wednesday, November 5.

ZOOLOGICAL SOCIETY.

JUNE 17TH.—The Viscount Walden, President, in the chair.—Mr. Sclater laid before the meeting the first sheets of a Catalogue of the Birds of the Neotropical Region, prepared by himself and Mr. O. Salvin, and shortly to be published under the title "Nomenclator Avium Neotropicalium." The number of species included in it, as known to the authors, was 3,565.—A letter was read from Mr. R. Swinhoe, containing intelligence of Père David's recent zoological researches in the interior of China, in the province of Shensi, south of the Ho-ang-ho.—Mr. Sclater exhibited and made remarks on a collection of birds recently made in New Guinea by Signor D'Albertis. The most remarkable of them was a new Paradise Bird, belonging to the Epimachine section, but peculiar for its long incurved bill, which was proposed to be called *Drepanephorus Albertisi*, after its discoverer.—Mr. J. W. Clark exhibited the Skull of a Seal from the Northern Pacific, which appeared to be *Halcyon Richardsi* of Gray, and explained his reasons for regarding it as indistinguishable from *Phoca vitulina* of the North Atlantic.—Papers and communications were read from Lord Walsingham, "On the Distribution of the different Species of Deer and other Ruminants of Oregon and North California,"—by Dr. A. L. Adams, "On the Osteology of the Maltese Fossil Elephants," in which was given the description of a large collection of remains discovered by him in Malta in the years 1860-1866. Dr. Adams referred these remains to distinct species, by Mr. H. J. Elwes, "On the Geographical Distribution of Asiatic Birds," in which he entered into the question of the best subdivision of the Indo-Malayan region,—from Dr. J. C. Cox, "On some new Species of Land and Marine Shells from Australia and the Solomon and Louisiade Islands,"—from Dr. O. Finsch, "On a new American Parrot of the Genus Chrysotis, proposed to be called *Chrysotis Bodini*," from Mr. W. S. Atkinson, "On a New Genus and Species of Papilionidæ, from the South-Eastern Himalayas, proposed to be called *Bhutanitis Lidderdalii*," by Mr. R. B. Sharpe, the fourth of a series of papers on African birds the present memoir dealt with the African Cuckoos, which were fully described, and their geographical distribution pointed out, three new species were proposed, viz., *Cuculus aurantiirostris*, from Senegal; *Ceuthmochares Australis*, from S.E. Africa; and *Coua olivaceiceps*, from Madagascar, the paper likewise contained a revision of the sub family Phœnicophainæ, in which two new genera, Rhynococcyx and Poliococcyx, were characterized,—by Mr. R. B. Sharpe, describing three new species of birds, proposed to be called *Macrodipteryx Sperlingi*, from the Bay of Malimba, W. Africa; *Chamætylas Poliocel*, from the Gold Coast; and *Baza erythrothorax*, from Celebes, by Mr. Sclater, "On the Curassows, based mainly upon Specimens now or lately living in the Society's Gardens," and gave details on their geographical distribution and on the variations of sex of the known species,—from Mr. R. Swinhoe, "On Chinese Deer, with Notices of the two New Species, proposed to be called *Cervus Kopschi* and *C. swopis*," by Mr. Sclater, "On the genus Ornithion of Hautlaub, and the Synonymy of the four known Species,"—by Mr. A. H. Garrod, "On certain Muscles of the Thigh of Birds, and their Value in Classification, founded principally upon the Examination of a large Number of Specimens that had lived in the Society's Collection."

ASIATIC SOCIETY.

JUNE 30TH.—E. Thomas, Esq., Treasurer, in the chair.—Mr. M. J. Walhouse read some notes, "On the Occurrence of European Mediæval Blades in some old Indian Weapons." On the death of the last Rajah of Tanjore the old armoury was taken possession of by the Government, and the best and most characteristic having been selected for the Madras Museum, the remainder was ultimately disposed of by auction. A number of weapons were obtained by Mr. Walhouse, some of which have the peculiarity of showing blades of European origin fitted into handles of elaborate and unmistakeably Indian devices. Some of the blades bear the initials of Christian epigraphs, such as I.N.R.I. Domine; another has the letters E D.R.O. on the one side, and, apparently, O U A.N. on the other, with a cross further up the blade. A dagger contains on both sides the name of the famous sword-smith, Andrea Ferara. Some broad-swords bear, besides copious legends, mystic signs and emblems, apparently masonic or Rosicrucian, or may be smith-marks. Since Indian steel has been famous for ages, Mr. Walhouse conjectures that the mysterious letters and signs may have been held to bear some magical or talismanic virtues which caused them to be sought for. Mr. Walhouse also drew attention to a peculiar and local Hindu weapon, a kind of boomerang or throwstick, called *valaytadi* in Tamil, which is somewhat similar to the boomerang of the Australian tribes, though the Indian weapon does not possess the returning power so remarkable in the Australian ones. They are now always made from the hard wood of the mimosa tree, and used in the chase; but in the Tanjore armoury there were several of steel, which in war must have been a formidable weapon. Mr. N. B. E. Baillie then read a paper "On the *Khurdj* or Mohammedan Land-Tax, and its Effect on the Tenure of Land in India." *Khurdj* is of two kinds, *mookdsumah* and *wuzeefa*; the former is a share of the actual produce, and is not due when there is none; the latter is a liability on account of a definite portion of land, and is due so long as the land is capable of bearing, whether the land be cultivated or not. To meet this liability there must be a permanent right to the productive powers of the soil, and, wherever land is subject to the *wuzeefa*, it will be found that a right of property in it has been first established in favour of some one, either by grant from conquerors or by reclamation from waste, before the *wuzeefa* was imposed upon it. Liability to *wuzeefa* is thus a test of ownership. Akbar's impost on the land was a *wuzeefa*, for which the cultivators, and none other, were made liable; and they were accordingly treated by him in his instructions to his collectors, and also by Aurungzebe, as the proprietors of the land. In the anarchy that followed soon after the death of Aurungzebe, the names of *mookdsumah* and *wuzeefa* seem to have fallen out of use, but we find that the liabilities of the *wuzeefa* cultivators were transferred to the *Khoodkasht* ryots; for we are told by Mr. Shore that, at the time of the perpetual settlement of the revenue in Bengal, there was a class of ryots who were "compelled to stand to all losses, and to pay for the land whether cultivated or not." These could be none other than the *Khoodkasht* ryots, for it is still their condition, and it may be fairly inferred that, with the liabilities of the *wuzeefa* holders, they succeeded also to their rights, without which, indeed, the liabilities could not be met. Their rights, however, were ignored in favour of the official Zemindars, with whom the settlement was made as proprietors of the land. It is generally admitted that some injustice was then done to the *Khoodkasht* ryots, and a tardy attempt to remedy it, so far as that can now be done, has been recently made by an act of the Indian Legislature.

GEOGRAPHICAL SOCIETY.

MAY 26TH.—Anniversary Meeting.—Sir H. C. Rawlinson, President, in the chair. The Founder's Gold Medal, for the encouragement of geographical science and discovery, was presented to Mr. N. Elias, for the enterprise and ability he displayed in sur-

voying the new course of the Yellow River of China, in 1868, and for his recent journey through Western Mongolia, *via* Uliassutai and Kobdo, during which he took a large series of observations for fixing positions and altitudes. The Victoria or Patron's Medal had been awarded in advance (in October last) to Mr. H. M. Stanley, for his journey to the relief of Dr. Livingstone. Gold watches, with suitable inscriptions, were awarded to Mr. T. Baines, for his long continued services to geography and his route-maps; and to Capt. Carlsen, for the circumnavigation of Spitzbergen and Nova Zemlia. The prizes to public schools for 1873 were as follows.—Physical Geography: Gold Medal, W. C. Hudson (Liverpool College); Bronze Medal, W. A. Forbes (Winchester College). Political Geography: Gold Medal, S. E. Spring Rice (Eton College); Bronze Medal, A. T. Nutt (University College School). It was announced that the special subject for the examinations in 1874, both in Physical and Political Geography, would be the British Isles. The following gentlemen were elected as Council and officers for 1873-4: President, Sir H. Bartle Frere; Vice-Presidents, the Earl of Derby, Major-General Sir H. C. Rawlinson, Sir Rutherford Alcock, and Admiral G. H. Richards; Trustees, Lord Houghton and Sir W. C. Trevelyan, Bart.; Secretaries, C. R. Markham and R. H. Major; Foreign Secretary, J. Ball; Councillors, Admiral Sir G. Back, Hon. G. C. Brodrick, Sir F. Buxton, Bart., Admiral R. Collinson, Earl of Ducie, A. G. Findlay, J. Fergusson, Sir T. F. Fremantle, Bart., F. Galton, Major-General Sir F. J. Goldsmid, Col. J. A. Grant, J. Murray, Sir C. Nicholson, Bart., Admiral E. Ommanney, Admiral Sherard Osborn, Gen. C. P. Rigby, S. W. Silver, W. Smyth, Major-General R. Strachey, Major Sir Harry Verney, Bart., and Capt. C. W. Wilson; Treasurer, R. T. Cocks, Esq.

SPECIAL EVENING MEETING.

July 7th.—Sir Bartle Frere, President, in the chair.—The following new members were elected:—Admiral Sir F. Grey, Messrs. C. Campbell, T. Dineen, G. Foggo, A. G. Fowler, J. O. Gordon, A. Keightley, D. A. L. M'Alpin, and W. Sowerby. Letters were read from Lieut. Cameron, R.N., commander of the East African Expedition in aid of Livingstone, reporting the progress he had made up to the 22nd of May last. He had then reached Rehennoko, 120 miles from the coast, on Stanley's line of march, and was making halt there, in order that Lieut. Murphy, with the remainder of the stores, might come up with him. By about the 26th the united party expected to recommence their march towards Unyanyembe.—A letter was also read from Dr. Kirk, giving a description of a visit he had recently made to Somali-land, and an account of its fertility and resources.—A paper was read "On a Boat-Journey up the River Wami (opposite Zanzibar)," by Mr. C. Hill, *attaché* to Sir Bartle Frere's Zanzibar Mission. Mr. Hill ascended the river twenty-three miles, and, from his own observations and the reports of the natives, believes it is navigable, by steamers drawing two or three feet of water, for a distance of 200 miles.—The President then gave an account of his recent visit to Zanzibar, the Comoro Islands, and Madagascar, as far as related to geography and ethnology. He described the change from the monotonous, sandy coast of Somali-land to the rich, coral-fringed Zanzibar region, as very striking and sudden, after passing the mouth of the Juba. The coast navigation near Zanzibar is rendered dangerous by the abundance of coral reefs off the shore; and he hoped a strong representation would be made to Government, so that the Hydrographic Department of the Admiralty might be authorised to undertake a new and thorough survey. The chief point in Sir Bartle Frere's ethnological observations was the contrast between the three races inhabiting this part of Eastern Africa, viz., the Somali, the Gallas, and the Negroes. The Gallas he had an opportunity of studying at the Rev. Mr. Wakefield's mission-station at Ribé, near Mombasa, where he saw about thirty, who had been attracted from the interior by the missionaries, and were being educated by them. They are a well-built and handsome people, with dignified bearing, and excite great hopes of their future improvement. Sir Bartle also gave a more favourable character of the Somali than former travellers.

ANTHROPOLOGICAL INSTITUTE.

June 17th.—Professor Busk, F.R.S., President, in the chair. Mr. J. G. Waller exhibited a series of bronze implements discovered on the site of an ancient camp near Hythe, Kent, and Mr. J. E. Price exhibited pottery and bones of bos found at New Southgate. Lieut. S. C. Holland, R.N., read a paper on "The Ainos." The following papers were also read:—"Account of an Interview with a Tribe of Bushmans in South Africa," by G. W. Stow, F.G.S. (communicated by the President), "Specimens of Native Australian Languages," by A. Mackenzie (communicated by the Earl of Kimberley), "A Brief Account of Three Microcephales," by Dr. John Shortt, "On a Patoo-Patoo from New Zealand," by Sir Duncan Gibb, Bart., M.D., "The Healing Art in the North of Scotland in the Olden Time," by Rev. Walter Gregor, M.A. "On a Hypogeum at Valaquie, I. of Uist," by A. Carmichael, "Heathen Ceremonies still Practised in Livonia," by the Baron de Bogouschefsky (communicated by Sir John Lubbock, Bart.), and "The Westerly Drifting of Nomads from the 15th to the 19th Century. Part XI. The Bulgarians," by H. H. Howorth.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

Tuesday, June 3rd.—Dr. Birch, F.S.A., F.R.S.L., President, in the chair. The following candidates were duly elected members of the society:—John Corbet Anderson, Esq., Croydon; Alexander Mackenzie Cameron, Esq.

The following papers were then read:—

1. "The Legend of Ishtar Descending to Hades." By H. F. Talbot, D.C.L., F.R.S., &c. In this valuable paper the author translates from the tablets the Goddess's voluntary descent into the Assyrian *Inferno*. In the cuneiform it is called the Land of No Return, and the Lord of Earth gives her a green bough of the *La* . . . tree to protect her life (comp. Virgil's Æneid). Ishtar passes successively through the seven gates, compelled to surrender her jewels, (1) her crown, (2) her earrings, (3) her head-jewels, (4) her frontlets, (5) her girdle, (6) her finger and toe rings, (7) her necklace. The Lord of Hades seeing her sends his messenger Namstar to greet her. But as she cannot return of her own accord to the upper regions, the heavenly triad Sun, Moon, and *Hea* or Hu (Lord of Mysteries) consult, and *Hea* raises a black phantom who performs a juggler's trick before the Lord of Hades; during which he gives to Ishtar a cup full of the Waters of Life, whereby she returns to the upper world, receiving at each Hades-portal the jewels she had been deprived of in her descent. The phantom is rewarded by the most exquisite meats, wines, &c. The Greek Fate *Atropos* is supposed by the author to mean No Return, and Hades (House of Eternity) is compared with the Hebrew *Od* and *Bet-Moed* of Job xxx. 23.

2. "On the Egyptian Preposition." By M. P. Le Page Renouf, F.R.S.L.—In most languages with which we are familar, prepositions are unchangeable particles. This is not the case in Egyptian. When expressing a relation between two substantives the Egyptian preposition may be considered as a relative pronoun, as well agreeing with an antecedent, and subject to changes dependent upon the number and sometimes upon the gender of that antecedent. These transformations, and others consequent upon change of signification or of grammatical position in a sentence, are described and exemplified.

3. "On a remarkable Babylonian Brick described in the Bible." By Richard Cull, F.S.A.—The object of this paper is to show that the word translated tile in the authorised version, ought to be translated brick, in Ezekiel iv. 1, as it is the same Hebrew word as occurs in Genesis xi. 3,—"Go to, let us make brick and burn them thoroughly. And they had brick for stone and slime had they for mortar." And secondly, to show that the word translated "pourtray" in the passage Ezekiel iv. 1, ought to be engrave, when the passage will stand,—"Thou also, son of man, take thee a brick, and lay it before thee, and engrave upon it the city even Jerusalem." With this accurate translation of the two words in the description, a brick with a design, or an inscription engraved upon it, may be recognised like the bricks now found in the ruins of the ancient cities of Mesopotamia.

METEOROLOGICAL SOCIETY.

June 18th.—Dr. J. W. Tripe, President, in the chair. The following gentlemen were elected Fellows:—N. St. B. Beardmore, R. H. Cooke, J. G. Marshall, and W. W. Rundell. The following papers were read:—"On some Results of Temperature Observations at Durham," by Mr. J. J. Plummer; "On the Meteorology of New Zealand, 1872," by Mr. C. R. Marten, "On the Climate of Vancouver Island," by Mr. R. H. Scott; "Meteorological Observations at Zi-Ka-Wei, near Shanghai," by the Rev. A. M. Colombel, with note by the Rev. S. J. Perry; "Notes on the Connection between Colliery Explosions and Weather," by Messrs. R. H. Scott and W. Galloway; "Distribution of Rainfall Maxima in Great Britain and Ireland, between the years 1848 and 1872 inclusive," by Mr. W. R. Birt; and "Note upon the Heavy Rainfall of March 4, at Natal," by Dr. R. J. Mann.—The Annual General Meeting was then held, when the Report of the Council was read. The Council stated that they had pleasure in congratulating the Society, at the close of the twenty-third session, upon the termination of a year which will bear favourable comparison with any that precedes it, whether regard be had to the character of the papers read, to the attendance at the periodic meetings, to the number of Fellows elected, or to the activity and interest evinced in the general proceedings. It was stated that it had been found necessary to hold an extra meeting in May, to enable all the papers which had been received to be presented before the Society; and the Council announced that it is in contemplation to hold eight monthly meetings next Session instead of six, as has hitherto been the practice. The number of Fellows added to the Society during the year amounted to thirty-five, the accession thus indicated being considerably larger than upon any year since 1864. After referring to the state of the library, the financial affairs, the proposed alterations of the bye-laws, and the Meteorological Conference at Leipzig in August last, the Council concluded by stating that they had had under consideration that evening a letter from the Board of Trade, with reference to sending a representative to the Meteorological Congress, to be held at Vienna in September next. The President then delivered an address, in which he briefly referred to the progress of the Society during the two years that he had occupied the Presidential chair. The following gentlemen were elected Officers and Council for the ensuing year:—President, Dr. R. J. Mann; Vice-Presidents, A. Brewin, G. Dines, H. S. Eaton, and Lieut.-

Col. A. Strange; Treasurer, H. Perigal; Trustees, Sir A. Brady and S. W. Silver; Secretaries, G. J. Symons and Dr. J. W. Tripe; Foreign Secretary, R. H. Scott; Council, C. Brooke, C. O. F. Cator, R. Field, F. Gaster, J. Glaisher, J. K. Laughton, W. C. Nash, T. Sopwith, Rev. F. W. Stow, Capt. H. Toynbee, C. V. Walker, and E. O. W. Whitehouse.

ARCHÆOLOGICAL INSTITUTE.

JULY 4TH.—Lord Talbot de Malahide, President, in the chair.—Sir J. Maclean reported the progress of the arrangements for the Exeter meeting, and stated that the Mayor of that city, being unable to be present that day, had desired him to assure the Institute of a hearty welcome. The Gallery of Portraits of distinguished persons promises to be an interesting feature of the Congress. The Hon. Secretary read "Notes of the Coptic Dayrs of the Wady Natrûn, and on Dayr Antonios of the Eastern Desert," by the Rev. G. J. Chester. Mr. J. H. Parker gave "Some Account of the most recent Excavations in Rome," at the conclusion of which he urged the importance of continuing the work, which was now at a stand for lack of funds. The Rev F. Spurrell read "Notice of the Stone Coffin of Ingelrica, Foundress of Hatfield Peverell Priory, Essex," which had been found in the course of recent works of restoration, and which was of the early part of the twelfth century. The Hon. Secretary read a communication from Mr Roach Smith, describing an "oppidum" on Hayling Island, Hants, called Tournabury. Mr. O. Morgan, M.P., exhibited a pedometer of the sixteenth century, a pedometer and counting machine, with calendar showing the year, month, days of month and week, the rising and setting of the sun, by N. Hager, of Arnstad, in Thuringia, date 1600, also, a nocturnal dial, with calendar of months and days, vane to show the quarter from which the wind blows, compass and telescope, by the same maker, also, a pedometer, compass and sun-dial, by Johan Melchior Landeck of Nuremberg, seventeenth century. Mr Henderson sent a Persian vase, probably not very ancient, of rich perforated work, and of a kind used for decorative purposes; also, a dagger of Stamboul make, with name of owner and passages from the Koran in early Arabic characters. The handle is richly carved, and probably of Agra work; also, an Indian dagger, in richly enamelled sheath, with carved jade handle, presented by Hyder Ali to Sir Hector Monro, and acquired from his son by Mr. Davidson. The Earl of Harrington sent a small "Madonna and Child," by Raffaelle, which had been presented to William, Earl of Harrington, by Phillip the Fifth of Spain, in 1729. Mr. J. James sent a collection of mediæval spurs, containing some remarkable specimens. Mr. Nightingale exhibited a damask table-cloth, in which were woven figures of St. George and the Dragon, shield with the arms of Queen Elizabeth impaling those of her mother, Anne Boleyn, the badge of Anne Boleyn, portrait of Queen Elizabeth, and the words "Qvene Elisabeth" and "God Save the Qvene," with a border of point lace, and marked E. R. Mr. Clark exhibited the Original Charter of the borough of Llantrissaint, 3 Henry 6. Mrs. Bever sent an early deed relating to Stratfield Mortimer, Hants, and Mr. Golding exhibited a commonplace-book of the sixteenth century, and sketches of a rood screen at Eye, Suffolk.

ENTOMOLOGICAL SOCIETY.

JULY 7TH.—H. T. Stainton, Esq, V.P, in the chair.—Mr. Weir exhibited specimens of *Agrotera nemoralis*, taken at Abbott's Wood, near Lewes. Mr. M'Lachlan exhibited a remarkable instance of hermaphroditism in a specimen of a fly (one of the Syrphidæ), taken at Black Park. Mr. T. Blackmore exhibited specimens of a gall, found on oaks, near Tangier, which were taken possession of for a habitation by a species of ant (*Crematogaster scutellaris*, Oliv.). Mr. W. Pryer exhibited some fine specimens of Lepidoptera, from China. Sir S. Saunders communicated a paper, "On the Habits of Economy of certain Hymenopterous Insects which nidificate in Briars, and their Parasites." The insects were exhibited at the last meeting; and Sir S. Saunders further exhibited a specimen of a Raphiglossa, which he had suffocated with cyanide of potassium whilst asleep, showing the remarkable position of the insect during repose, as described in the paper. Mr. Butler communicated a list of the species of Galeodides, with description of a new species in the British Museum.

CHEMICAL SOCIETY.

JUNE 19TH. Dr. Odling, President, in the chair.—The following communications were read:—"Researches on the Action of the Copper-Zinc Couple on Organic Bodies," III.; "On Normal and Iso-propyl Iodides," by Messrs. J. H. Gladstone and A. Tribe, being a continuation, in the propyl series, of the authors' previous researches. "On the Influence of Pressure on Fermentation," Part II., "The Influence of Reduced Atmospheric Pressure on the Alcoholic Fermentation," by Mr. H T. Brown, in which he finds that, under diminished pressure, the progress of the alcoholic fermentation is retarded in a remarkable way. "On Cymene from Different Sources optically considered," by Mr. J. H. Gladstone. "Note on the Action of Bromine on Alizarine," by Mr. W. H. Perkin, this reaction gives rise to *bromalizarine*, an orange-coloured crystalline substance, possessing feebler dyeing properties than pure alizarine, the colouring principle of madder. "On some Oxidation and Decomposition Products of Morphine Derivatives," by Messrs. E. L. Mayer and C. R. A. Wright. "On the Decomposition of Tricalcic Phosphate by Water," by Mr R. Warington. Communications from the Laboratory of the London Institution, No. XII., "On the Nature and on some Derivatives of Coal-Tar Cresol," by Dr. H. E. Armstrong and Mr C. L. Field; "On a New Tellurium Mineral, with Notes on a Systematic Mineralogical Nomenclature," by Mr J. B Hannay, and "Note on the Relation among the Atomic Weights," by Mr. J. A. R. Newlands. The President congratulated the members on the flourishing state of the society, and on the number and importance of the papers that had been read during the session.

REVIEWS

(Continued from Page 128.)

practical men the confusion regarding "space" and "surface" seems to be very great.

To return, however, to my subject. Suppose the height of the chamber were diminished, the condensing surface is increased, and there is nothing admitted into the chamber which would tend to baffle the draught in any way—indeed, according to the shape of the proposed chamber, the draught will be rather increased, we also bring the gases more in contact with any already-formed acid at the bottom of the chamber, which I have shown determines very rapidly the action between the gases. This form of chamber also would be much more easily managed than the one now in use, which, from its very unwieldiness, involves the manufacturer in many expenses which are, in reality, perfectly needless. If, again, the item of expense be considered, I think every one will agree that the expense of building a chamber half the size of that in use at present would be a very considerable advantage to the manufacturer. The dimensions of the chamber I would recommend are as follows:—

Length, 160, 200, or even 210 feet.
Width, 30 feet, increasing in ratio to length.
Height, 10 feet, and for any length of chamber the height should not be increased.

I feel confident from my own experience, encouraged greatly by my experiments, that the foregoing size of chamber would be much preferable to our present large sized ones, and would not only give a much larger yield of vitriol from the same expenditure of sulphur, but would, in the more matter even of chamber room, be of great value to the manufacturer.

Before leaving this part of my subject, I would like to notice two methods of working sulphuric acid chambers which seem to me to deserve special attention—those of Mr. Ward and Mr. Gossage.

The method proposed by Mr. Ward consists in adding more condensing surface to the chamber, by the introduction of glass sheets or tubes, placed horizontally and longitudinally in the chamber upon which the acid condenses.

Mr. Smith gives a detailed description of this apparatus from Richardson and Watts' Technology, also of Mr. Gossage's patent, A.D. 1857, and then proceeds:—

A great cry used to be for a large chamber—one with plenty of room in it—this was the idea of one of our greatest manufacturers, whereas the idea embodied in Mr. Ward's patent is much nearer the truth, although it is not quite it; at least, it seems to me we have in it a perplexity of means to attain a simple end. Mr. Ward has first a small mixing chamber into which the gases pass before entering the large chamber, when the greatest amount of condensation takes place. Again, the presence of the glass tubes in such large quantity may serve, as Mr Ward himself says, to baffle the draught. What goes on in Mr. Ward's two chambers is exactly similar to that occurring in the one chamber in general use in sulphuric acid manufacture, with the difference that Mr. Ward gives additional condensing surface. But the chamber in which the glass tubes are placed (which after this I will call the second chamber) must be proportional in size to the amount of sulphur admitted to the chamber, so that if he had fewer kilns he would require to curtail the length of the second chamber and most probably the capacity of the first—that is to say, he would simply have less condensing surface. (I say the length of the second chamber, as I do not for a moment imagine he would further baffle the draught by diminishing the height or width.) Here, then, it appears to me we have rather a useless expenditure of appliances. If Mr Ward did away with the interior padding of his second chamber, and raised its height, say, to 8 or 10 feet, with a corresponding difference in width, still, however, keeping the same length, he would have, for an average amount of acid, obtained a less expensive chamber, and one which would be quite as efficient for the required purpose. I have shown in a preceding page that in the ordinary chamber the greatest amount of action between the gases takes place at the bottom of the chamber, whilst little or no action takes place above, if then the chamber be extended in length, and diminished in height and width, the required purpose is answered. Let the draught be only moderately fast, and from one chamber pass the gases into another similarly constructed (as is done now with the present form), and we have a very inexpensive chamber, in fact, we have the greatest amount of work done with least outlay. This is evidently the principle of Mr Gossage's chamber, only he recommends a vertical instead of a horizontal passage of the gases. There is one great drawback, however, in this process; he does not allow the gases to be exposed to the surface on which they condense most readily—I mean the surface of already-formed sul-

phuric acid. I have already shown that the action between the gases takes place much more rapidly when sulphuric acid is already present in the vessel; and this is a fact well known to some manufacturers; but if Mr. Gossage's chambers were to be laid horizontally instead of vertically, there would be a great exposure to this surface, and therefore a greater yield of acid, and would also be the form of chamber which Mr. Ward recommends, minus the padding, and the one which I have already said seems to be distinctly pointed out by chemical analysis and careful investigation of the various conditions under which the maximum amount of sulphuric acid is formed.

The Little Dressmaker. Fashions for children and dolls. Edited by Mme. Schild. Containing a beautiful illustration of the latest fashions for children's and dolls' clothing, with the cut paper patterns, &c. July No. London S. Miller, 37, Tavistock Street, Covent Garden, W.C.

This work continues to sustain its useful and pleasant character, the number before us being equal to any that has preceded it.

"The Gateway to the Polynia."

"A Voyage to Spitzbergen." From the journal of John C. Wells, R N. With numerous illustrations. Henry S. King and Co., 65, Cornhill, and 12, Paternoster-row. 1873.

"The Story of a Life and Two Sequels" By Wm. Alfred Gibbs. The Critics' Edition. London: Provost and Co., Covent Garden. 1873.

We are not able to do more at present than acknowledge the receipt of these works.

SANDERSON AND PROCTOR'S IMPROVEMENTS IN BOILERS AND FURNACES.

These boiler's generators are constructed in globular form, with hot air tubes passing through the same, and also, if required, a ring or endless tube, is added, providing a steam or water space, communicating with the steam and water space of the globular part, such ring, or endless tube, being available as a superheater, or as an additional steam space. The furnace arrangements consist of five bars concentrically arranged so as to converge to central upright shafting, which should be tubular to allow the same to be prolonged and connected with the bottom of the boiler, so as to be utilizable for the blow off, and the entrance for feed water to the boiler. One end of each such fire bars can thus be supported in such shafting, and the bars be revolved by means of a turn-table, and by a pendant to each bar, which pendant comes in contact with a stationary bar, or by gearing, the fire bars can be continually tilted, so as to remove clinkers, and reduce the amount of stoking required.

The bars are to be inclined towards the central shafting, so as to cause the fire to correspond with the form of the boiler. The furnace can be fed by a hopper or otherwise.

Instead of having, as above described, hot air tubes passing through the water space of the boiler, we can, if desired, reverse this arrangement, and have water tubes, and fire or heat space surrounding them. Messrs. Sanderson and Proctor, of Huddersfield, are the inventors and patentees of this important invention.

WEST'S DRESS STUDS.

The object of this invention is to produce studs, or solitaires, or other similar fasteners for garments of two separate parts, which are capable of being attached, or detached, by the use of the arrangement such as hereafter described, and such a stud, from its greater facility of manipulation, its superior neatness of appearance, and greater comfort to the wearer, will be found more advantageous than one in any plan hitherto adopted.

The above object is effectuated by making one part of the stud as a hollow plate, or as may generally be preferable by forming a small box, or case thereon, in which is fitted a spring catch or equivalent for the purpose hereafter described. In the centre of one part of the stud is the shank or solid pin similar to that ordinarily used. Through the end of the hollow plate, box, or case project the ends of the catch or equivalent, which ends might, however, if desirable, be brought together to form only one end. The other part of the stud has a hollow pin or shank, which is to be fitted on to the solid pin herein before mentioned; and when fitted in the spring catch secures it in its place, and holds the two parts of the stud or fastener firmly together. By pressing the end of the spring catch the pin of stud will be released, and the two parts can be separated and removed from the person if demanded.

The inventor and patentee of this ingenious and useful article is William West, of Hockley, Birmingham.

GLEN'S IMPROVEMENTS IN TRAMWAY CARS.

Recently at the Royal Scottish Society of Arts, Mr. T. Ivory, president, in the chair, Mr. Geo. Glen, upholsterer, read a paper on "Improved Tramway Cars." The cars as at present constructed, he said, must, in taking the curves, not only affect the draught of the horses, but also increase the tear and wear of wheels and rails, and cause frequent lifting and relaying. A look at the cars will show that the wheels did not adapt themselves to the curves; their running off the rails or on to wrong lines proved this. He produced a model of his invention, the wheels of which, he pointed out, adapted and adjusted themselves to every curve that might come in their way, and reduced the friction to the smallest possible degree. The principle of his model admitted of the wheels farther apart, thus giving a greater bearing to the whole car and removing a considerable strain from the frame-work. On the principle of his model the driver was enabled, by means of a lever in front, to take the points with the greatest certainty, and with considerable relief to the horses compared with the present system. The usual brakes could be applied in his invention, and a very simple cleaner could be attached, which might be used or not as required. The three leading points of his invention were the double axle, the action of the bogie to secure straight radial lines, and a diagonal rod for the purpose of controlling the back wheels and taking points. After the reading of Mr. Glen's paper, several members made observations upon it, chiefly with the view of having the invention explained in its details. —*Scotsman*, May 13th, 1873.

APPLICATIONS FOR PATENTS.

Continued from Page 122.

Locomotives (com)—J. R. Bennett. Mode of working the slide valves of steam engines.—J. Hinks and H Holland. Manufacture of gas for heating and illuminating, and the utilisation of residual products of the said manufacture.—J. Whichcord and W. Anderson. Manufacture of slabs and panels applicable to strong rooms and safes.—W. R. Lake. Engraving and chasing machines (com.)

On June 10th.—2050 to 2062.—W. F. Hayward. Iron safes, and locks or fastenings for the same, part of which improvements are applicable for other purposes. — W. Lockwood. Means employed for converting iron into steel.—T. Stafford. Machinery or apparatus used in making laps of cotton and other fibrous substances.—J. H. Sandy. Galvanic batteries, and the fittings, mountings, and apparatus connected therewith.—G. Garrett. Machinery for finishing metal tubes.—J. Marley and E. Thompson. Construction and arrangement of the flues of coke ovens, especially with reference to the consumption of smoke fumes and gases.—E. Hinchliffe. Manufacture of woollen and other fabrics.—T. Stebins, A. Rosenfield, H. Mayers, and W. F. Leon. Hydraulic hoisting apparatus, including an improved friction clutch, an improved safety device for elevator cages and an improved governor or brake for regulating the descent of the cage. (Complete specification.)—J. H. Johnson. Umbrella frames, and the process of and machinery for manufacturing the same (com.)—J. H. Johnson. Moving and raising coal and other granular material, and the machinery or apparatus employed therein (com.)—J. H. Johnson. Rolling mills (com.)—J. H. Johnson. Casting chilled rolls (com.) (Complete specification.)—J. Taylor, M.D. Apparatus to be applied to the sights of fire-arms.

On June 11th.—2063 to 2077.—S. Kingan. Refrigerating apparatus (com.)—G. Haseltine. Furnaces for producing wrought iron directly from the ore (com.) (Complete specification.)—J Nettlefold. Secretly and accurately recording by machinery the votes given at the election of members to serve in Parliament, and at other elections when secret voting is required, called the "Balloting engine"—C. Farrow. Construction of iron wine bin.—W. Neil. Refiner for distilling apparatus. (Complete specification)—D. Williamson Thinning turnips and other crops, and the machinery or apparatus employed therefor.—W. Phillips. Apparatus for marking or scoring and registering billiards and other games, and for other similar purposes.—H. Wincen. Gas meters.—J. Leigh. Mode of treating sewage and other contaminated waters.—C. D. Abel. Apparatus for decorticating hop bines so as to obtain therefrom fibre for the manufacture of paper pulp, cordage, woven fabrics, and for other purposes to which vegetable fibre is applicable (com.)—G. A. Bridgett. Steam engine expansion gear and governors.—J. G. Smith. Automaton balances for weighing coins and coin blanks (com)—J. Guenard. Machinery for drying coffee and grain.—L. Bopp-Du-Pont. Self-acting cooking apparatus.—W. Rowett. Manufacture of electric telegraph cables or ropes.

The residues from molasses are used in France for the manufacture of carbonate of potash.

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*** Communications to the Editor to be addressed to him at 21, Cockspur Street

CONTENTS.

ATTERBURY'S IMPROVEMENTS IN PERMANENT WAY FOR RAILWAYS FOR SEA AND LAND.

WE AGAIN CALL THE ATTENTION of railway contractors, the Government and others to this system of lines for railways, whereby cheapness and durability are, it appears, combined, as regards material, in such a manner that a line once laid down in accordance with his invention would retain its durability for an indefinite length of time, no wooden sleepers of any kind being used, and the line itself constructed upon a peculiar principle, without using iron rails, bolts, or chairs as at present, and in case of accident to the carriage it is claimed that the line would not be disturbed or torn up as under the present system of railway lines.

On the Severn Railway, Gloucester, each tube of twelve feet in length, [illegible] tons at £10 per ton will be [illegible] 0 [illegible] miles over the Severn. The cost would be £1[illegible],940 in iron alone.

Mr. Atterbury writes to inform us that this can be effected without stopping the Severn or the navigation, after the first segment is put down. One mile per day can be constructed on this principle. Mr. Atterbury also remarks that a railway from Dover to Calais (21 miles) could be constructed very cheaply on this plan, if the work be carried on without delay, by the latter end of July, 1874.

Mr. George Atterbury's address is [illegible], West [illegible].

APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur-street, Charing Cross.

On June 12th.—2078 to 2088.—C. Hall. Receptacles used for holding and pouring out liquids.—L. Fieret. Method of producing and reproducing drawings, devices, and designs on porcelain, delph ware, and such like materials (com.)—W. R. Lake. Apparatus for casting copper and its alloys under pressure (com.)—R. Mathers. Driving drums, strap pulleys, or riggers.—M. Mirfield and J. Scott. Machinery for combing wool, cotton, silk, and other fibres.—W. A. Peirce and J. Peirce. Window-blind furniture.—E. W. D. Gray. Printing machines and machines for folding printed sheets.—E. Yewdall. Thermal reflector stove.—Sir W. Thomson and F. Jenkin. Telegraphic apparatus.—F. Hogg. Neckties.—A. F. Campbell. Common road carriages, and appliances to be fitted thereto or arranged therewith.

On June 13th.—2089 to 2106.—C. R. Western. Apparatus for planing, tonguing, and grooving wood, more particularly applicable in the preparation of parquet flooring.—J. G. Garrard. Peg or holdfast for securing tents, strengthening telegraph poles, tethering horses, and for other similar purposes.—H. A. Bonneville. Conductors for telegraph wires (com.)—H. A. Bonneville. Supports for berths, cabins, and shelves for sea-going vessels (com.) (Complete specification.)—S. J. Ditchfield, C. Watson, and J. Childs. Heating apparatus, and the application of hydrocarbon or other volatile oils or spirits for heating purposes and generating steam.—J. Moir and R. J. Miller. Hanging and working window and other curtains.—E. Rowse. Apparatus for obtaining motive power.—P. J. Guinane. System of round spring cartridge box for revolvers and other fire-arms.—J. Kidd. Steam traps (com.)—H. R. Robson. Governor apparatus for compound marine steam engines.—J. Spurge. Apparatus for paring and slicing potatoes, apples, and other vegetables and fruits (com.)—W. R. Lake. Horse-shoes (com.)—F. H. Greer. Telegraphing and collecting electricity for telegraphing and other purposes.—D. G. Fitz-Gerald and R. C. Molloy. Voltaic batteries.—A. Higginson. Apparatus or appliances for regulating or controlling the supply of steam and other elastic fluids to motive-power engines.—E. Campanes. Treating broom, "genista" (Spartium scoparium), thus utilizing and turning to account a fibrous plant heretofore unused, and the method of dressing or preparing such fibre for the manufacture of twine, cord, thread, and other like materials or fabrics (com.)—J. Crouch. [illegible]

printing presses and appliances for feeding and distributing the ink or colour to such presses —

On June 14th.—2107 to 2114.—J. Thomas and A. Piggott Lamps for burning petroleum and other mineral oils—S. H. Emmens and E. C. Rippin. Mode of working signals and points on railways, and apparatus employed therefor. (Complete specification.)—H. J. H King Apparatus for feeding wool, cotton, or other fibrous materials to carding or other machines.—T. Pirie. Implement for breaking up land.—W. Nisbet. India-rubber waterproof fabrics.—J. H. Wilson. Machinery for tilting barrels, casks, or other receptacles.—C. Cochrane. Treating pulverulent iron ores for smelting.—E. C. Hamilton. Manure

On June 16th—2115 to 2124.—J. B. Croskey, F.S.A., F.R.G.S. Pavements.—E. Hobbins. Manufacture of cements, plastic and pulverized compounds combined with chemical and other materials, suitable for being employed in the production of plain and ornamental slabs, moulded and other objects and surfaces, architectural concrete and other structures to which such cements and compounds are applicable, and in the means and apparatus employed in such manufacture, also treating surfaces, objects, and structures preparatory to applying such cements or compounds or other cementitious materials thereto.—C. H. Sharp and R Parkinson. Washing machines for washing clothes, linen fabrics, and similar articles.—J. Cass. Comber boards and harness used in weaving —F. H. Grey and W. Harris. Breech-loading express rifles and other small-arms.—J. H Wilson. Steam winches for loading and discharging ships' cargoes and for other purposes E. Malhère. Machinery for the manufacture of lace—E. Hodgson. Revolving camera—D. Ker. Spirits, wines and other liquors.—R. C. Baxter. Apparatus for raising, lowering, engaging, and disengaging ships' boats and other bodies (com)

On June 17th.—2125 to 2134 —J Manock and E. Manock Machinery for redoeing and screening or riddling artificial manures and other substances.—B. J. B Mills. Vulcanisable waterproof gum and process for producing the same (com.)—B J. B Mills. Cars or carriages for railways (com)—F J. Noble. Ratchet braces —E Beanes Brewing and treating fermented liquors.—J. W. Stead. Steelyards for weighing machines.—T. Culpin. Reaping and mowing machines—R. A. Ray. Composition for removing and preventing scale or incrustation in steam boilers.—G. Little. Automatic telegraph apparatus for preparing paper and transmitting and receiving messages for use with the system of telegraphing known as "Little's automatic telegraph."—H. E. Newton. Apparatus for coupling railway carriages and waggons (com)

On June 18th.—2135 to 2145—W. L. Wise. Steam generators (com.)—C. J. Coxhead. Damper action in pianofortes.—G Fowler Apparatus for facilitating the charging and discharging of tubs or corves on to and off the cages of lifts.—J. W. Thompson. Lining-bands for hats and caps, and material to be used in lieu of leather for other purposes.—G. N. Sanders and G. N. Sanders, jun. Spikes, pins, bolts, nails, and analogous fastenings, applicable for securing spikes, chairs, and other fastenings.—T. Davison. Spring safety valves.—W. Firth. India-rubber springs for use as draw springs, buffer springs, and bearing springs, and also as segments or sections of elastic tyres for carriage wheels and similar uses—E. Evans. Portable apparatus for heating water and other liquids, applicable for baths and other purposes.—J. Norris. Apparatus for measuring and registering corn, seeds, and grain —E Tuck. Conservatories, greenhouses, and other glazed structures.—R. H. Tweddell, E. Wilson, H. Ashbee, and J. Platt. Facilitating the rivetting of girders and other structures.

On June 19th.—2146 to 2155.—J. Richmond, Joshua Richmond, and T. Richmond. Registering press.—A. B. McGregor. Hydraulic cements (com.)—W. Ross. Clipping, bottoming, and gathering turnips.—E. Easton. Opening, closing, and securing the doors of strong rooms and safes.—J. N. Paxman. Feed-water heater. —A. Parkes. Manufacture of metallic alloys and apparatus to be used for this purpose.—H. L. McAvoy. Carburetting air for illuminating or heating purposes.—W. Mort. Cooling and freezing machines (com.)—J. Barrow. Slotting and planing metals.—H. J. West. Removing air from the interior of casks or other vessels, and filling them up with beer or other liquid (com)

On June 20th.—2156 to 2167.—C. Brown. Preserving wood.—G. Spencer. Railway breaks, and the framing and parts of carriages suitable for use with the same (com.)—A. Henry. Breech-loading fire-arms, part of which improvements are also applicable to the locks of ordinary fire-arms.—J. Glendenning. Curtains or flexible partitions for school-rooms, and apparatus for raising and lowering the same.—G. Langlands and J. Johnston. Shuttles.—G. A. Page, jun. Travelling valise or knapsack (com.)—G. Nimmo. Steel furnaces —J. M. Morris. Apparatus for producing mechanical illusions in theatrical exhibitions, parts of which apparatus are also applicable to other purposes —C T. Colebrook. Steam cylinders for steam pumping machinery and steam engines.—D. Ainsley and P. Hall. Boring machinery.—T. Murphy. Machinery for cutting or forming cork, wood, bark, and such like materials into stoppers for bottles and vessels, or into articles of similar character.—E Whitworth. Reaping machines and apparatus for making up cut crops into sheaves

On June 21st — 2168 to 2178 —J Platt and R H. Tweddell. Rivetting and punching machinery. —C Binks. Materials for and methods of decarburating cast iron and converting iron into steel — J Griffith. Steam boilers. (Complete specification) F Wirth Turbines (com)—A. A. Crespin Transmitting despatches and the apparatus connected therewith.—W H Mitchell and R Jordinson Carding engines. K M. P. Loutit Manufacture of gas for heating and lighting purposes, and the apparatus employed therefor. C P Moody Implements for cultivating land. L Griswold Sewing machine (Complete specification) — A G Hunter Apparatus for the manufacture of gas for illuminating and heating purposes (com.) A M Clark Tanning and otherwise treating hides and skins (com)

On June 23rd 2179 to 2191.—C C. Cramp. Locomotive engine for tramways, railways, and other purposes —C C Cramp Improved rotary engine —M Trattles. Making portable fires useful in army camps, also private and public offices, and general domestic purposes, can be carried in the open air for light warmth on the road in foggy weather.—F Zysl. Motive power —J H Parkinson Looms for weaving. — C. Touaillon. Horse shoes (com) S Herrick. Treadles for sewing machines. (Complete specification)—S A. Samuelson Locomotives, traction engines, and other carriages moved by steam power.—J. Whitehead. Dandy rollers used in the manufacture of paper.—A. G. Brookes Rotary engine to be worked by steam or other fluid (com)—T. Whitehead and H. W Whitehead Improvements in "Noble's" combing machines.—A. M. Clark. Machinery for printing oil cloth or other fabrics (com.) (Complete specification.)—W. G. Ingall and C. J. Parsons. Coffin furniture

On June 24th.—2192 to 2205 —A. Sweet. Water-waste preventers and waste-preventing cocks, taps, or valves.—W. Powell Breech-loading small-arms.—W. E. Gedge. Machine for paring or cutting and shaping heels for boots and shoes (com.)—J. Macintosh. Tobacco pouches or receptacles for containing tobacco, applicable to other purposes —W. H. Holm. Looms for weaving.—W. Jenkins. Prevention of leakage in wooden casks.—R. Willacy. Spreading or distributing manure or other substances over ground —R. Nicholson. Junctions for gas and water mains and branches.—H. E. Newton. Bits for horses and other animals (com.)—J. Stubbs and J. Corrigan. Machinery for winding two or more yarns or threads of cotton and other fibrous materials on to one bobbin or spool preparatory to doubling the same.—A. V. Newton. Fastening of hat pegs or hooks (com.)—D. Pidgeon and W. Manwaring. Reaping machines.—J. Evershed. Tanning hides, and apparatus to be used for this purpose.—A. M. Clark. Feed-water heating apparatus for steam boilers (com.)

On June 25th.—2206 to 2216.—J. Stewart. Mode and means of constructing buoys or apparatus for floating bodies in deep water, and thus saving life and property.—R. Tomlinson and R. Moss. Looms for weaving.—E. T. Hughes. Pickermotion (com.) —J. Imray. Modules or apparatus for regulating and measuring the delivery of water or other liquids (com.)—W. Spence. Engines worked by volatile liquids at a low temperature

(com.)—J. Mahon. Instruments for drawing corks.—G. Haseltine. Braiding attachments for sewing machines (com.)—E. E. Asquith and F. A. Greenwood. Machinery for spinning, doubling, and twisting fibrous substances.—O. C. D. Ross.—Production of vapourised air for heating purposes generally, and in means for regulating and controlling the admixture of vapourised and other air when employed for such purposes.—N. Ager. Apparatus to facilitate the opening and closing of apertures in barrels, cisterns, and other similar vessels.—E. Mapplebeck Copper tubes and copper-coated brass tubes.

On June 26th.—2217 to 2224.—G. Haseltine. Apparatus for extinguishing fires (com.)—L. Schwarz. Process for economising fuel by the use of steam. (Complete specification.)—T. Mansbridge. Obtaining increased security to the locks of doors or gates to rooms and other places.—W. R. Lake. Process and apparatus for preserving meat, fruit, vegetables, and other like perishable substances (com.)—G. T. Bousfield. Tunnelling (com.)—J. M. Plessner. Inkstands.—J. Carter. Machinery for spinning, doubling, and twisting fibrous substances.—T. Payne. Invention of "Payne's anti-corrosive boiler fluid."

On June 27th.—2225 to 2239.—C. W. Siemens. Electrical apparatus for sending by means of finger-keys, and for receiving and printing telegraphic messages, parts of these improvements being also applicable to electric telegraphic apparatus generally (com.)—J. Boyd and T. A. Boyd. Machinery for winding yarn or thread. —A. Kimball and J Morton. Sewing machines. —J. Milroy. Columnar foundations for piers, quays, and similar structures.—B. Johnston. Composition for preserving buildings, ships, or any structure whatever exposed to damp or wet, or any other external influences —M. Eustice, M D., J Kennan and T Kennan. Apparatus used in the cultivation of green crops.—B. Hans, jun. Dial indicators for checking the drivers of public carriages. (Complete specification.)—F. H. Varley. Transmitting and recording telegraphic signals and means of transcribing.—W. Rowan. Steam engines with a general arrangement of valves for the ingress and egress of the steam, and the mode of applying and working same.—J. Partridge. Means of and appliance for preventing carriage and other wheels leaving the axles in cases of breakage or from other causes.—G. T. Bousfield. Lamps to be used for cooking, heating, and lighting purposes (com)—A. R. Arrott. Soda and chlorine —J. Hunt. Artificial fuel.—F. Curtis. Sewing machines, and channelling and bevelling machines connected therewith (com.) (Complete specification.)—E. H. Hale. Bottle wrapper.

On June 28th.—2241 to 2257.—G. E. Laverack. Apparatus to prevent passengers from opening the doors of railway carriages whilst the train is in motion, applicable also for simultaneously securing and releasing the doors of the cells of prisons, asylums, or for other similar purposes where a series of simultaneous actions are required.—R. A. Gooding. Securing corks in bottles containing fluids under pressure.—W. Wright. Improvements in and applicable to steam boilers for the purpose of increasing the draught and utilizing the products of combustion therein.—T. Singleton. Machinery or apparatus used in the preparation of yarn, and in the manufacture thereof into textile fabrics.—D. A. Graham. Manufacture of gas and the apparatus employed therein.—C. W. Siemens. Caloric engines (com.)—J. Carter and J. E. Carter. Water or stench traps.—A. W. Hosking. Combined cheque, facsimile, and receipt book.—W. E. Garforth. Steam pumps for raising or forcing fluids.—J. Rose. Actuating slide valves.—[illegible] Simon. Mixing machine.—T. [illegible], W. Richmond, and J. Dodgson. [illegible] when weaving textile fabrics.—[illegible] T. F. Pearson, and J. [illegible]. Woven fabrics. —E. Field. Apparatus for preventing or counteracting incrustation in and detaching it from steam boilers or apparatus for imparting heat to liquids.—G. Haseltine. Valve gear for direct-acting steam engines (com.) (Complete specification.)—J. F. [illegible]. Boot [illegible].—[illegible]. Inhaling apparatus (com.) (Complete specification.)

On June 30th.—2258 to 2272.—H. A. [illegible]. Machines for spinning wool, cotton, [illegible] fibrous materials in general (com.)—[illegible] [illegible]. Water, liquid, gas, and [illegible] gauges (com.)—J. H. [illegible] [illegible] air [illegible]

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SEPTEMBER 1, 1873.

COMPULSORY PATENT LICENSES.

REPORT OF HON. COMMISSIONER OF INVENTORS' INSTITUTE TO THE INTERNATIONAL PATENT CONGRESS AT VIENNA.

The question referred to in the heading of this column is clearly so important, and is so ably dealt with by Dr. Collyer, the Hon. Commissioner of the Inventors' Institute to the Congress at Vienna, in his report, that we feel that we cannot do better than devote our first pages to that Report.

Report.

On Monday, the 4th of August, the Congress met for the first time in the Grand Hall of the Jury Pavilion in the Exhibition Grounds. There was a large number of members present.

His Excellency Baron von Schwarz-Senhorn, as Director-General of the Vienna Exhibition, opened the Congress with an address of welcome delivered in both the German and English languages, expressive of his sense of its great importance

The Congress then proceeded to the election of its officers, and elected by acclamation, on the proposition of the preparatory committee, His Excellency Baron von Schwarz-Senhorn, honorary president, Mr. William Siemens, C.E., F.R.S., D.C.L., &c., member of Council of the Inventors' Institute, London, acting president; Mr. Thomas Webster, Q.C., London, Government Councillor; Dr. Franz Neumann, of Vienna; Dr. Werner Siemens, of Berlin; Dr Eugen Langen, of Cologne, President of the Society of German Engineers, and Mr. Hamilton Hill, of Boston, United States, vice-presidents, to which number was added, on the proposition of Baron Schwarz, Aulic Councillor, Chevalier von Engerth, of Vienna, and the chief of the Patent Office in Vienna, Dr. von Rosas, Dr. Ratkowsky, Vienna, Professor Dr. W. F. Exner, Vienna, Dr. Rosenthal, Cologne, Mr. Carl Pieper, C.E., Dresden, and Professor Blake, New York, and Mr. Knupe, of St. Petersburg, secretaries.

The meeting having adopted the order of proceedings, and the rules to be observed during the debates, the Congress entered upon the consideration of the propositions prepared by the preparatory committee, which were as follows:—

I. That protection of inventions is to be guaranteed by law in all civilised countries.

Protection by patent, if guaranteed in an adequate and judicious manner, will be conducive to stimulate useful inventions, to improve the mode of production, thereby increasing production itself, and making it cheaper, and to extend the consumption, thus promoting national welfare. On the other hand, if there be none, or an inadequate protection of inventions, national industry will become stagnant and retrograde, the spirit of invention will be stifled, the introduction of new inventions checked, and the native inventor forced to seek a more favourable field of action elsewhere, where his talent will be recognised and his labour protected and rewarded.

Introduced by Mr. Carl Pieper, C.E., of Dresden.

II. If the object of patent protection is to be attained in an adequate manner, it will be imperative that the various States should bring about, as speedily as possible by international agreement, a reform of the patent legislation.

III. As regards the rules to be established, the Congress [illegible] the English and American laws as a [illegible] of a law proposed for Germany by the [illegible]

Introduced by Dr. [illegible] Grothe, of Berlin.

IV. As fundamental principles for an International agreement on patent legislation, the following points should be kept in view:—

(a.) It is desirable that the various States should publish and exchange all patents directly after they have been granted, in such a manner that copies of each patent may be inspected by the inhabitants of other countries.

Introduced by Professor Dr. Klostermann, of Bonn.

(b.) It would be, if at all possible of accomplishment, advisable that each State should admit and attach to its patent office representatives of other countries.

Introduced by Professor Dr. Klostermann, of Bonn.

(c.) It is to be recommended that a system of preliminary examination should be adopted, analogous to the provisions of the laws above mentioned.

Introduced by Dr. Rosenthal, of Cologne.

(e.) The expenses of obtaining and keeping in force a patent should be moderate in all countries, and based upon a progressive scale.

Introduced by Professor Jaunasch, of Prokau, in Silesia.

(f.) Only the first inventor, his heirs and assigns, are entitled to a patent.

Introduced by Dr. Ratkowsky, of Vienna.

In place of, as originally prepared, Resolution I, "The protection of inventions is to be guaranteed by law in all civilised countries," &c., as above, was introduced to the Congress in a long and much applauded speech by Mr. Karl Pieper, C.E., Dresden, dilating on the present state of the patent legislations, supported by statistical data, in America, England, &c., with the patent legislation of which countries that of Prussia contrasted most unfavourably, as being the worst in existence, in practice and application, Dr. William Siemens, proposed to adopt the following:

GENERAL PROPOSITIONS.

The International Congress may please to declare:

"Patents of inventions with obligatory publications are necessary and indispensable to the preservation and promotion of technical progress, because:

"a. They offer the only practicable and effectual means of introducing, without loss of time, and in a satisfactory manner, new ideas and improvements to the general notice of the public.

"b. They render the work of the inventor remunerative, and thus induce men of talent to devote their powers, time, and means to the introduction and carrying out of new methods of manufacture and technical improvements, or attract foreign capital, which, without patent protection, would seek and find a safer investment elsewhere.

"c. By the obligatory and complete publication of the invention forming the subject of the patent, the great sacrifices of time and money, which would be otherwise imposed upon the industry of all countries by carrying out inventions, will be considerably diminished.

"d. The manufacturers' secrecy, which is the greatest enemy of industrial progress, loses thereby its principal support.

"e. The countries which have no good patent laws are injured greatly in consequence of the emigration of their inventive talents to those countries in which their labour and their products are legally protected."

The general debate on this proposition was not without interesting incidents. Dr. Werner Siemens, in a very clever speech, explained, in a precise manner, the reasons for maintaining the system of patent protection, which contributed most effectually towards the speedy extension and application of new inventions. It was this protection of inventions which was the death-blow to the secrecy of manufacture, which through generations clogged all progress. Then came a declaration from the minority—the party opposed to all patents—for whom Professor Dr. Neumann (Vienna) acted as spokesman. He stated that already, ten years ago, he had publicly given utterance to the same views, and he and his friends, though small in number as yet, were of opinion that the principle of liberty, i.e., the principles of free trade, must also be applied to inventions and patents. The latter were incompatible with the progress of our time, with free trade; they were opposed to all principles of liberty, as could be proved by their own history, since they were intended as a compensation for the rights formerly possessed by corporate institutions and guilds.

The President then formally announced to the assembly that Dr R. H. Collyer, of London, was received as the duly accredited Honorary Commissioner from the Inventors' Institute

On the general question, as to the advisability of patent rights being accorded to the inventor,

Dr. Collyer said—Nature had not endowed all mankind with the same genius or mental qualifications in the development of new ideas in regard to the amelioration of the wants and necessities of society. Every day experience taught that great disparity existed amongst men, as to their capacity to become inventors or discoverers in the true sense. Civilisation, education, and progress were promotive of invention, but then, for a man to become a successful inventor, a special education was required in regard to the subject-matter of his invention, in a word, it would be futile for a man to attempt making improvements in those departments of the arts which required a knowledge of chemistry without being acquainted with that science, the same applied to mechanism It is true that suggestive ideas often arise in the minds of intelligent persons who are unacquainted with either chemistry or mechanism, but such were necessitated either to themselves undergo a special course of training or to resort to the assistance of the expert in those subjects, if the ideas thus conceived required to be practically brought into operation or public use Dr Collyer next dwelt on the fact that society had framed laws for the protection of *property*, in fine, the chief function of the law was the protection of property in one form or another. How was property attained if not by mental or by bodily exertion? In the present day the really useful application of our time to the accumulation of the means of existence in the various forms of every-day life, required the exercise of the brain. No one refused to recompense the professional man, the mechanic, or artisan for his work. If, then the inventor, whose education and talents render him fittest for the vocation, devote his time money, and attention to the special improvements of society—what reason is there for excluding this labour from the category of the remunerative? *None*. A patent is a compact between society and the inventor A special right granted for a few years only is indeed but a niggardly recompense for what society receives the perpetual benefit of There has arisen a mistaken idea in reference to a patent being a monopoly As a patent is only a grant for that which had no prior existence, it is difficult to imagine how such a confusion of terms should have occurred A monopoly is a grant of the exclusive right or liberty to a person or persons in regard to something which up to the time of such grant was free to the enjoyment of everybody It is thus an *abstraction* of something from the common rights of the public, whilst a patent for a new invention operates to procure *addition* to those rights The protection of the development of a new application in the arts or manufactures cannot therefore be a monopoly according to any recognised meaning of the term. All inventors were of opinion that their rights had not been heretofore protected by law in consonance with the spirit of the age What inventors demanded was a patent law framed by those who understood the necessities of the inventor, many of whom were working men, and others who possessed very little wealth. All the patent laws now existing were devised by mere lawyers, who had generally followed their own fanciful theories as to patent rights being in restraint of trade. It was to be desired that an international law should be based on enlarged and broad principles, such as will really protect the poor inventor, for it was as true now as when first enunciated that "necessity is the author of invention." All the really great inventions have arisen from the necessity—the necessity of the improvement, and the *necessities* of the man The greatest incentive to mental exertion is that prompted by the ambition to become rich and powerful. *Inventions* at all periods of the world's history has offered the greatest prize for human labour. No one possessed of a right sense of what constitutes the greatness of nations could ignore the pretensions of the inventor in demanding from the State the most liberal legislation in protecting his *rights*, attained by dint of the hardest and most toilsome of all labour—mental function—in the development of a new idea as applicable to the wants and necessities of his fellow man

The original resolution, as amended by Mr. Siemens, of Berlin, "That the inventor-rights be recognized by a suitable international patent law," was put to the assembly, and carried with only four dissenting votes

After this proposition had been thus disposed of a number of other resolutions, which had been agreed upon by the Preparatory Committee, were brought under consideration. The programme, including that above stated, being as follows —

"Resolution I. The protection of inventions is to be guaranteed by the laws of all civilised nations under the condition of a complete publication of the same, because

"*a* The sense of right of civilised nations demands the legal protection of intellectual work

"*b* This protection affords the only practical and effective means of introducing new technical ideas, without loss of time, and in a reliable manner to the general knowledge of the public.

"*c* The protection of invention renders the labour of the inventor remunerative, and induces thereby competent men to devote time and means to the introduction and practical application of new and useful technical methods and improvements, or to attract capital from abroad, which, in the absence of patent protection, will find means of secure investment elsewhere

"*d*. By the obligatory complete publication of the patented invention, the great sacrifices in time and of money, which the technical application would otherwise impose upon the industry of all countries, will be considerably lessened

"*e* By the protection of invention the secrecy of manufacture, which is one of the greatest enemies of industrial progress, will lose its chief support

"*f* Great injury will be inflicted upon the countries which have no rational patent laws by the native inventive talent emigrating to more congenial countries, where their labour is legally protected

"*g* Experience shows that the holder of a patent will himself make the most effectual exertions for a speedy introduction of his invention."

"Resolution II.—An effective and useful patent must have the following principles.—

"*a*. The inventor or his legal heir only can obtain a patent. A patent cannot be refused to a foreigner.

"*b*. In order to carry out the principle stated above (*a*), the introduction of the system of a preliminary examination is recommended.

"*c*. A patent for an invention should be granted for fifteen years, or the option should be to extend it to that period.

"*d*. The granting of a patent must be accompanied by a detailed and complete publication, which renders the practical application of the invention possible.

"*e*. The cost for the granting a patent should be moderate, but in the interest of the inventor an increasing scale of fees should be fixed, so as to cancel all useless patent as soon as possible.

"*f*. It should [illegible] obtain, through a well-organised patent office, the specifications of any patent, as well as to ascertain which patents are still in force.

"*g* Laws should be passed by means of which a patentee may be compelled, in cases of public interest, to allow the use of his invention for a suitable remuneration to all *bonâ fide* applicants."

For the rest, and especially with respect to the proceedings in the granting of patents, the Congress refers to the English, American, and Belgian patent laws, and to the proposition made by the union of German engineers for a patent law of the German Empire.

"Resolution III.—In consideration of the great difference between the existing patent laws, and in consideration of the altered state of international communication, the necessity of reform becomes evident, and it is to be strongly recommended that the different Governments should endeavour to arrange, as soon as possible, an international understanding on the patent laws.

"The not executing of a patent in a country is no reason for its becoming void in that country, as long as the invention has been carried out once, and the possibility is there that the right of using the invention can be obtained by any inhabitant of this country "

COMPULSORY LICENSES.

The above proposition (*g*) as to compulsory licenses was originally as follows :—

"It is desirable that measures be adopted by which the patentee shall be compelled to allow any one to use his invention who may desire it."

This came on for discussion at the sitting on 7th Aug, 1873, when Dr. R. H. COLLYER, the hon. commissioner of the Inventors' Institute, rose and said —

It has been stated here that compulsory licenses would appease the opponents of the patent system—such men as Sir William Armstrong, Mr. Macfie, and others, because such licenses would take away from patent right the principal objection, namely, that of being a monopoly. This is certainly the most important question that has or will come before this Congress. There is widespread error as to the true meaning of the word monopoly. Originally and truly it meant the grant of an exclusive privilege by the king or prince, for which he received a remuneration, to one person in a city or district in the vending of the necessaries of life. One man had a monopoly to sell and make bread, another to vend meat, another clothing. This was a gross violation of public common rights, an injustice of the most intolerable description, as the public were thus forced to purchase the ordinary necessaries of life at exorbitant prices. See how entirely different to this is the granting of letters patent to an inventor for a novel invention, which is only founded on a right already possessed—a man's dominion over his own thoughts—one which had no prior recognition and limitation of a right in regard to things having no previous existence. It therefore could not injure the body politic, and it could not take away any existing rights or privileges. In short, it could not be regarded as a monopoly in the usual or legal signification of the term. What is a patent right at the best but a niggardly recognition for a limited period of years conceded to the original and true inventor, who has devoted his time, mental labour, and expended his means in the completion of the invention, the adoption of which will ameliorate or remove the defective condition of a want which society requires, which, after the few years of the patent right, has the entire benefit of the invention in perpetuity. What does all property rest upon, whether in goods, houses, lands, [illegible] [illegible]

the opponents of patents attach to monopoly is be followed, are all monopolies, as no one has a right to sell or use the goods, to trespass on the lands, or enter the house of another without his permission. Certainly, if he were obliged to grant a license to any one who wished to sell or use his goods, or chose to apply to enter his house, or traverse his lands, they would no longer belong to himself. In this sense, all property is a monopoly, as it is an appropriation to one as against the many. All legislation, from the earliest periods, has tended to maintain this great principle, that whatever a man obtains by his industry belongs to himself. If, then, this holds good as to material possessions, how much more obvious must be the reason which should concede to a man that which he mentally creates when calculated to benefit his fellow-man. The first idea of a compulsory license emanated from certain members of the Inventors' Institute. It has been the topic of constant discussion for several years past, and I am in a position to declare that, with scarcely an exception, the idea has been strenuously opposed by the practical inventor. It originated in the minds of those who really had no experience as to the troubles, the difficulties, the annoyances, the expenditure of time and money in the development or exploitation of novel inventions. It is, as a rule, not until an invention has attained many years of practical existence that even the inventor himself is enabled to remedy the practical deficiencies incidental to nearly all new inventions in the early stages of their existence. As a rule, it would require at least five years to do so. If the compulsory license were to be granted on the issue of the patent, what would be the consequence? A rich manufacturer, or a capitalist, would extinguish the original inventor, and render his patent valueless so far as he was concerned. The compulsory license system would be most unjust—I might say iniquitous—in its working. Take the case of two rival manufacturers—one, in order to improve and cheapen the mode of production, outlays a fortune in making experiments so as to render his invention perfect, the other manufacturer, who belongs to the "leave-well-alone" class, who has incurred no risk, spent no money, and has not devoted a moment's mental labour on the subject, by the payment of a ridiculous license fee, has all the advantages of using the invention, and competing with the man whose ingenuity, perseverance, and risk of failure, entitles him alone to the prize. Inventions do not come from the brain—as Minerva from the head of Jupiter—perfect, armed *cap-a-pie*. The history of nearly all inventions is a narrative of progressive development of practical perfection. If ever any proposition was calculated to undermine and destroy the ambition—the *amour propre*—the perseverance of the inventor—it is the knowledge that he is labouring, perhaps for years, spending all his resources for the benefit of those who would, by the payment of a paltry pittance allowed by themselves or their friends—use the invention, and who would have it in their power to destroy its successful introduction if it suited their purpose so to do, or make an important improvement, secure a patent, and leave the original inventor with no remedy, ruined; and this would often be the case in practice. Suppose the inventor who, after spending much time and all his money to perfect or improve the existing mode of manufacture, fails entirely to arrive at a successful result—and this is no imaginary case, it occurs every day—what, then, is his reward but scoffs, and the jeers of his fellows, for having been such a madman as to ruin himself in attempting to get a fortune? How many, many, real inventors, die unknown in the world in penury and want? [illegible] he deprives his family of the necessaries of life so that his means, poor as they are, may go towards the development of his invention. This is but a faint portraiture of the actual state of things. But when a man, by his indomitable perseverance, and by the exercise of his genius and mental capabilities, achieves the object of his research, why is the fruit of his labour to be taken from him by an artfully-devised plan of compelling him to grant a license to whomsoever may desire it? It behoves us to acknowledge the great boon which modern invention has conferred on society—the steam engine, lighting by gas, and the electric telegraph. All these great inventions, and many others, have been gradually developed. These splendid results and applications of scientific truths to the wants and necessities have been attained by constant trials and experiments. The theme is inexhaustible, and my object now is not to elaborate or enter into details of the advancement of special inventions, they are no doubt familiar to you all. But I must appeal to you, in the name of common sense, not to ignore the fact that no one is so competent or capable of bringing his invention to perfection as the inventor himself. Gentlemen, we are now treading on most dangerous ground, for the adoption of the proposition before us would virtually take from an inventor by a side wind, or artfully-devised strategy, every benefit which he would otherwise enjoy, if his patent is trammelled with a clause obliging him to grant a license to whomsoever may desire to obtain it. By it the original patentee, whose conception has brought into existence a new creation of mechanical or chemical application, may be ousted by some other person, of no original genius, no inventive mind, though quick to apprehend, and keen to perceive practical defects of detail. He at once demands a license from the original patentee, takes out another patent for so-called improvement, and actually ruins the original inventor, whose genius, time, and money, brought the new thought into practical operation. Indeed, such a clause would be opening the door to all kinds of fraud and deception, as the inventor will be necessitated in self-protection to present his invention to the world in such a shape as to prevent his rival from utterly destroying its commercial value. Therefore, as the hon. commissioner of the Inventors' Institute of Great Britain, in the performance of an imperative duty, I must vote against the original proposition that the inventor should be absolutely and unreservedly, and at once, compelled to grant licenses to use his patent, the only modification that I am prepared to assent to is, that after at least five years from the issue of the patent, a license, under certain regulations may be issued to any responsible applicant, provided the peculiar circumstances of the case may render this necessary for the maintenance of the industrial interests of the public. We want no favours, we only advance just claims, and will not knowingly make concessions to appease those whose only argument is the false proposition that a patent for a novel and useful invention is a monopoly.

After two days' discussion the amended resolution (*g*), above given, was passed by a vote of 42 for and 17 against.

At the closing of the Congress the committee was constituted as a permanent executive committee, with the power to publish the resolutions adopted, and to submit them to the various Governments. The committee is also authorised to choose members, and to prepare and convoke in a suitable manner a second Congress.

On Saturday, the 9th of August, the president and members of the council of the patent Congress, were introduced by Baron Schwarz to the two Ministers of the Austrian Empire, to whose department the resolutions of the Congress belong.

Reviews.

Ventilation of Buildings. A Paper read before the Society of Civil and Mechanical Engineers, 10th of January, 1873. By W. F. BUTLER, Hon. Treasurer. London: Kell Brothers. 1873.

THIS paper is a very praiseworthy essay on the important subject referred to. The following amusing sketch of ancient attempts at ventilation, with some remarks on its true nature and effects, will afford the reader a good specimen of the nature of the work:—

That ventilation is a new requirement will, I think, be readily acknowledged, when we consider the every-day life of our forefathers who lived prior to the close of say the 17th century. We shall see that, in by far the larger number of cases, theirs was an out-of-door life. Their days were spent mostly in the field either in the sports of the chase, in war, or in the occupation of husbandry.

If they were wealthy, their halls were large and lofty, with enormous fire-places, and loosely fitting doors and windows, from which innumerable currents of air rushed to the fires. If they were poor they had, amid all the dirt and wretchedness which surrounded them, no want of air, as any one who has seen an old English or Welsh cottage will readily admit.

The windows, too, down to nearly the period I have named were, in most cases, filled with nothing better than shutters or louvre boards, glazing being then a rarity, at least in houses of the commoner sort, for though glass was known to the Phœnicians and to the later Egyptians, whose glass works at Sidon and Alexandria were famous throughout the then civilised world, and although it was employed by the Romans to some extent in their windows, as is shown by the remains found in Herculaneum, window glass was not manufactured in England, I believe, prior to the middle of the 16th century, and must up to that time at least, and probably long after, have been an article of luxury, while its substitutes, oiled paper or plates of horn, can hardly have been in general use, at least in the dwellings of the poorer classes in country districts.

In cities and towns, doubtless, greater comfort if not better sanitary arrangements prevailed. But these were always the strongholds of fever, plague, and cholera. In towns the "black death," so much dreaded in the 14th century, had its headquarters, and from them it extended its devastating arms into all the surrounding country. I believe that to defective ventilation not less than to bad drainage and insufficient water supply, may be traced these scourges of the human race, which now seem rapidly giving up their strongholds to the invading forces of science.

We cannot wonder on looking at such places as the hall of Hedingham Castle, for instance, in which were two fire-places, each about 5½ feet wide and 7 feet high, that people found a settle, a comfortable article of domestic furniture, and viewed the chimney corner, where they crowded like smoked hams, as the choicest parts of the room. Nor must we be surprised when we are told that the curtains enclosing the couches whereon reposed the proudest beauties of the land shook in response to every wind that blew.

If the wretched hole which they show in Carnarvon Castle as the birthplace of Edward II. be indeed the room in which that unhappy prince first saw the light, I can only say that whatever advantages the men of a former age may have had over us, certainly domestic comfort could not be said to be one of them.

The first person who seems to have turned his serious attention with any practical result towards the subject of this paper, w[illegible]

least in England was, I believe, Dr Desaguliers, who, in 1723, was called in to ventilate the House of Commons, upon which Wren had before tried his hand

The doctor discharged his commission with success, but he unfortunately provoked the hostility of one very important individual, viz., the housekeeper, a certain Mrs. Smith, who effectually extinguished him by not lighting the fires, upon the action of which his system depended, until the House had sat for some time, and the Chamber had got thoroughly heated, so that we cannot wonder some of the members should have considered the design of cooling the House was frustrated, and requested the doctor to employ other means He accordingly invented a centrifugal wheel, or blowing machine, so constructed as to force air either into or out of the House, according as either was required. This machine was put in charge of a man called the ventilator, whose duty it was to wait upon Mr. Speaker every day for orders. Dr. Desaguliers was next applied to by the Admiralty to ventilate ships, but here, as might be expected, he got inventors' allowance, viz., more kicks than halfpence All his troubles with Mrs. Smith were nothing compared with the treatment he and his invention received from Sir Jacob Ackworth, the surveyor to the Navy, who seems to have been the *beau ideal* of an official. When the doctor attended by appointment on board the ship in which his machine was to be tried, Sir Jacob did not appear, but hearing that the company were pleased, afterwards told Dr. Desaguliers that at the next experiment he (the doctor) need not attend, as the carpenter could manage the ventilation

When the second trial came off, Sir Jacob had scuttle holes cut at each end of the ship and then hoisted enormous wind sails, and when, as might naturally be expected, he found that more air came through his wind-sails, which were about 2' 6" diameter, than through the Doctor's tubes, which were 5" × 3'; he said he could not stay longer, and that he was sorry the machine had answered no better Sir Jacob, however, sent his "humble duty to Dr. Desaguliers, and thought his invention might be a very pretty thing in a house.

The Lords of the Admiralty never came near nor gave themselves any trouble about it, and so the doctor found his invention would not be used in the Navy

The next person who came forward in the cause of ventilation for the Navy, was Mr Sutton, a brewer by trade He made use of the fire which cooked the provisions of the ship's company as the motive power, laying pipes from all parts of the ship to the ash-pit under the grate When the ashpit-door was closed, no air could get to the fire except through the pipes.

The result was considered satisfactory, and the apparatus was ordered to be fitted up on board the *Norwich* man-of-war

Mr. Sutton had also to contend with Sir Jacob Ackworth, but he had found powerful friends in Dr. Mead, the king's physician, and Sir Charles Wager, so that the old knight's opposition was rather passive than active.

This, I believe, is one of the first if not the first, instance of the scientific use of the common fire as the power for ventilating any structure. This method has been called thermo-ventilation by Mr. Bernan, to whose work, as well as those of the inventors, whose names I have mentioned, I am indebted for many of the particulars given above

However successful Mr. Sutton may have been in getting his apparatus fixed, he failed when he applied to the Admiralty for some reward for his services; they simply took no notice of him or his petition, although the *Norwich* had returned to England from the Guinea Coast, with the loss of only two men, and the Captain reported her singularly healthy.

Meanwhile, a certain Dr. Hales had been pressing an invention of his own upon the notice of my lords. This he called a ship's lungs The machine was, in fact, a magnified bellows, differing somewhat in construction from common bellows certainly, but the same as far as action was concerned. It consisted of a large square case with valves, enclosing a hinged mundrif, which rose and fell by the action of a long handle or lever, worked by some of the ship's company. The whole machine was cumbersome, requiring about four men per hour to work it, and could not, certainly, compare with the blowing wheel of Dr. Desaguliers. It soon fell into disuse, and became a thing of the past

Mr. Sutton, who had at last got £100 from the Admiralty, exulted over the failure of the ship lungs, but his triumph was short lived for, in the course of a few years, he found that he was left out in the cold also, and the old wind-sails were again on duty.

The illustrious names of Count Rumford and H Davy, as well as those of a host of other persons less celebrated, which figure in the annals of ventilation, attest the importance of the question It is time, however, for me to take leave of this portion of my subject, of which volumes might be written, and to consider the causes which make ventilation a necessity.

These may be classed under different heads, viz., first in private houses. The necessity for ventilation will arise from commonly (A) the presence of fires, (B) artificial light; (C) the presence of persons living in the house, that is from the air required by them, as well as the exhalations from their bodies, and (D) from badly constructed water closets, cesspools and drains. 2nd. In factories there will be, in addition to the above causes, the presence in the air of a vast quantity of minutely-divided fibre and dust, which is highly prejudicial to the health of the workers, and also the fumes from chemicals, &c., where the manufacture of such is carried on (3rd.) In sewers. The necessity of sufficient ventilation will almost entirely arise from the generation of poisonous gases by the putrid filth carried down. (4th.) And in underground railways, the fires of the engines, and the saturation of air by the waste steam will render ventilation, in certain cases, necessary.

In a similar strain Mr Butler proceeds to elucidate the practical *rationale* and details of ventilating arrangements and appliances, for which we refer the reader to the work itself

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The Prevention of Poverty, or Progressional Economy as a System of Natural Law, and Reform as a Science. By WILLIAM VOLCKMAN London Trubner and Co., 57 and 59, Ludgate-hill.

ALTHOUGH we do not care to fill our pages with political or even semi-political matter, yet the subjects Mr. Volckman deals with are of such wide-spread importance that we cannot help introducing his pamphlet to the notice of our readers, more especially as in his opening pages he gives a brief explanatory statement of his views, from which our readers will get a good idea of what they may expect to find in the work itself, which, being very cheap, everyone feeling an interest in the matter should get and read for himself. It appears from Mr. Volckman's statement that this essay was simply intended as the opening to an evening's debate at the London Dialectical Society, before which body it was read, on Wednesday, March 19th, 1873, under the title, "On money and interest:—On some of the elements, conditions, and infringements of well-being:—On politico-economic partnership." Its idea was suggested by a discussion at the Dialectical Society in the autumn of 1872,—but so far as it concerns such debate the paragraphs 124 to 131 in the work indicate.

Mr. Volckman adds: For its reproduced form, a more general title is adopted, and I have thrown into the illustrative chapters the remarks upon "money and interest" as subordinate to the larger subject. By way of partial amplification, however, such extra paragraphs have been included within the present outline as will serve to indicate the current of my ideas more clearly than was possible in a limited reading. The additional chapters are, for the most part, an extension of my notes for reply to the debate, many of which escaped utterance by reason of the restricted time.

In anticipation of a possible misapprehension, I urge that my paper is no attempt whatever at the advocacy of a "rhapsodical" "Arcadian" system of life, or, of any absurdly levelling scheme of wealth distribution and redistribution. On the contrary, it is one of my objects to show the needlessness of such views or schemes, and the sufficiency of natural economic law for a diversified well being Human society, I contend, is naturally and *de facto* a progressional and economical partnership; so endowed by birthright as to be well nigh secure against the possibility of poverty, if the natural conditions of its endowments be but properly understood and obeyed. Such "endowed partnership" (accident apart) is not only a provision of well-being for all, it is also the guarantee of that enlightened liberty and individuality so enjoyable to each, and so fruitful of general advancement. And the laws too of such partnership, being natural, find their highest expression, I also contend, in a developed, rather than in an initial civilisation, dealing as they do with beings whose very nature is progressional. For the humanitarian economy herein exhibited I claim, in its entirety, its adaptability to present phases of society, altogether apart from recourse to projects of experimental socialism As a corollary to the various positions assumed throughout, I assert reformation to be a science—the evolvement of which is sadly barred by a dangerous and impatient sectarianism.

Throughout the pamphlet the term "law" or "principle" is used in the experimental sense as denoting a deduction from an observed or invariable sequence of phenomena. When otherwise applied, the context sufficiently reveals the distinction. The word "State" or "Community" is variously employed, as signifying pluralities of individuals, up to and including the whole world. The more salient laws of progressional economy are printed in italic type, as being principles shown by experience to be ceaseless in activity, alway beneficial in harmonious action—but in their infringement invariably productive of calamity.

At some sacrifice to the movement of my remarks (and while maintaining their original form as a debate introduction) I have supplied "headings" to the various sections, for the purpose of bringing the sequence into prominence. I may plead this in some extenuation of crudeness, meanwhile directing attention to the arrangement adopted, which forms the scheme for a more matured and comprehensive work. Paragraphs 10 to 58 detail the natural laws of progressional economic partnership; paragraphs 59 to 80 consider natural economic law in biased action; paragraphs 81 to 102 deal with reform as a science; and the work concludes with several illustrative chapters.

We cannot afford space for a general review of Mr. Volckman's working out of the broad principles above enunciated; suffice it to say that Mr. Volckman is intelligent, earnest, and no bigot. However, we cannot refrain from making the following quotations, as we fully believe that the absorbtion of the political mind in questions of governmental forms and party shibboleths are merely red herrings drawn across the path of human progress:—

Republican agitation, says Mr. Volckman, as a reformatory procedure is at least unse-

quential, if not indefinite—is certainly raising a secondary issue. If it really proposes as its object developments of natural progressional economy (such, for instance, as "Land Redemption," or the "Capitalisation of Labour"), why not avow such reforms primarily, leaving the subsequent question of "governmental mode" to take care of itself, as certain of sympathetic adjustment to every economic victory, and as insusceptible at any rate of a too precise anticipation.

Republicanism, it may be inferred from its assertiveness, assumes its method to be a fitting pioneer or developer of a sounder economy, social and political. But how will it prove that it is either on the one hand a fitting developer, or on the other a necessary outcome of economic harmony? Surely, if the past and present may speak, this is somewhat uncertain ground upon which to rest an agitation. For history proclaims that "governmental form" of every type (Republicanism included) has been put forward, or has operated, over and over again as a diversion from the profoundly real and tangible work before earnest reformers; the work, which if well done can never fail of developing its own true "form of government," whatever that may prove to be.

Citizens, while you are enthusiastically agitating this question of governmental mode, capital and labour are fighting over and over again their interminable quarrel, the land is further from your grasp, education is barely making a snail's progress, and pauperism is counting its millions. If you really wish for a weapon wherewith to secure the utmost of economic harmony; if you really desire to ascend the first step of reform, why not bring to lasting terms of peace the great middle and working classes? For what power could withstand such forces when united by a common interest for common objects, who, indeed, would dare deny to them whatever they might righteously ask? And such procedure is manifestly sequential and evolutionary, for of very necessity reformation springs from the soil, and from the root. Harmonious action there promises in due season the harvest you, indeed, are manfully seeking, but which your inverted husbandry cannot forestall, and may disastrously retard.

General Literature.

The Gateway to the Polynia A Voyage to Spitzbergen. From the journal of JOHN C. WELLS, R.N., with numerous illustrations. London: Henry S. King and Co., 65, Cornhill, and 12, Paternoster-row. 1873.

SINCE M. de Lesseps, who, in despite of the notion that engineering enterprise was a British monopoly, planned and constructed the Suez Canal, the search for the North-West Passage to the East Indies has ceased to have the same practical interest that it formerly possessed; nevertheless the scientific interest of such explorations as means of increasing cosmical knowledge is still as strong, if not so active, as in the days of our old Arctic navigators, and we quite agree with the author of this very pleasant and practical work, that "Arctic voyages have yielded good fruit in the past, and there is every prospect of greater gains accruing to science from the explorations of the future."

Although we deem this book to be one of interest to men of science, we shall here present it to our readers as a work which they may profitably take up with when light pleasant reading is their object rather than scientific study.

In the introductory chapter of the work the author gives a brief history of the various Arctic voyages, which he commences with the statement that Columbus visited Iceland in 1477, and even sailed a hundred leagues beyond it. This history he closes with the remark that except at a few points we know very little respecting the seas and lands situate to the north of about 75°. The degree of flattening in the Polar region and hence true form of the earth, can only be ascertained by the measurement of arcs in all latitudes, or by numerous pendulum observations. This is a point, the settlement of which is of considerable importance in physical science. Very little is known respecting the meteorology of the Polar region. After entering into the consideration of the fact that high temperature exists in this region in the summer, and a very low temperature in the winter, he justifies his assertion that science has much to gain from the prosecution of Arctic explorations when scientifically conducted.

This voyage in the Spitzbergen seas commenced thus:—The author received an invitation from a friend, casually given, to join him in two days' time at the port of Hull, from whence he intended to sail on a summer cruise to the far north, in his schooner-yacht, which left but little time to make the necessary arrangements for an undertaking of this kind. But the desire to see the wonders of Arctic enterprise, peculiarly interesting at the present time when the question of Arctic exploration is before the world, rendered doubly important by the general enquiry into the action and influence of the Gulf Stream in high latitudes. All which considerations led to the invitation being accepted notwithstanding the shortness of time for preparation.

The good ship leaves port and merrily proceeds on her voyage, the narrative of which is enlivened by recounting whaling exploits, encounters with icebergs, seal catching, bear hunting, sea perils, ice perils, graphic accounts of natural scenery of the grandest kind, often illustrated by engravings, and these, together with much pleasant reading as to the beasts, birds and fishes to be found in the neighbourhood of the Northern Seas, form the staple matter of this book, which is a truly pleasant and instructive production, and one, though worthy of being resorted to by men of science generally, is yet singularly well adapted for presentation to an intelligent youth just entering upon manhood.

The Story of a Life, and Two Sequels By WILLIAM ALFRED GIBBS. The Critics' Edition largely revised, and in part rewritten by the Author. London: Provost and Co., 36, Henrietta street, Covent Garden. 1873.

REFRESHING it is, in these days of rampant sensationalism, when crime and moral delinquency are staple themes for those who wish to be thought highly of as successful authors of works of imaginative literature, to meet with a poet like Mr. Gibbs, who delights in pourtraying things honest, and of good report, and doest well.

This "Story of a Life," though published to the world some time ago, and well received in accordance with its deserts, is worthy of being again and again brought under the notice of the public, for much may be found in it to be read with pleasure and profit.

As already intimated it is no story of crime and passion, or the sense of vicious propensities falsely presented as unrestrainable human impulses. It is, in truth, a story of a life the exact counterpart of that led by many hundreds of men and women in this country. But though not "sensational," as that term is now understood, it is not prosaic, nor devoid of passion and sentiment of that kind which all persons of correct taste would consider as soul-stirring and poetic in a high degree.

By the revision of the work Mr. Gibbs has not in any way injured the poem; on the contrary, he has greatly improved it.

The following extract, which refers to an aspect of every-day life that cannot fail to interest most men and women of our day especially at the present vacation season will serve to justify the statements we have made:—

How few in this mad age of feverish haste
Know aught of their own land, save that it hath
A score or two of central salient points,
Or bustling minic "Londons" on the sea,
To which, and from which, they rush to and fro,
Half suffocate with smoke, foul smells, and dust,
Half stunned with hideous, harsh, incessant clank,
Whisked past fair valleys, towns, and villages,
Hurled into sulphurous darkness with wild yells
Of the ear-splitting whistle's sudden scream
Then hustled out as the drear journey's end,
Shaken in body, feverish in mind,
Into a striving, struggling, seething mob
Of anxious, selfish, motley inhumanity.
Contrast this so-called pleasure-seeking
With the unhurried after-breakfast stroll,
The morning drive across the breezy hills,
Through undulating vales and shady woods,
By winding lanes, whose every gentle turn
Changes the landscape with a shifting scene,
Whilst various odours float upon the air
From hawthorn hedge, field blossoms, or fresh hay,
No harsher noises than the light swift wheels,
The ringing harness, and the horse's hoofs,
Which all combined drown not the lark's sweet song,
Nor scare the timid linnet from the bush.

REVIEWS of the following works are unavoidably postponed:

"The Moon." By R. A. Proctor, B.A., Camb. Longmans.

"Mitchell's Manual of Practical Assaying." 4th edition. Edited by William Crookes, F.R.S. &c. Longmans.

"Sewage Utilization." By H. R. Burke. Spon.

"The Paradise of Birds" (poem). By J. W. Courthope. Blackwoods.

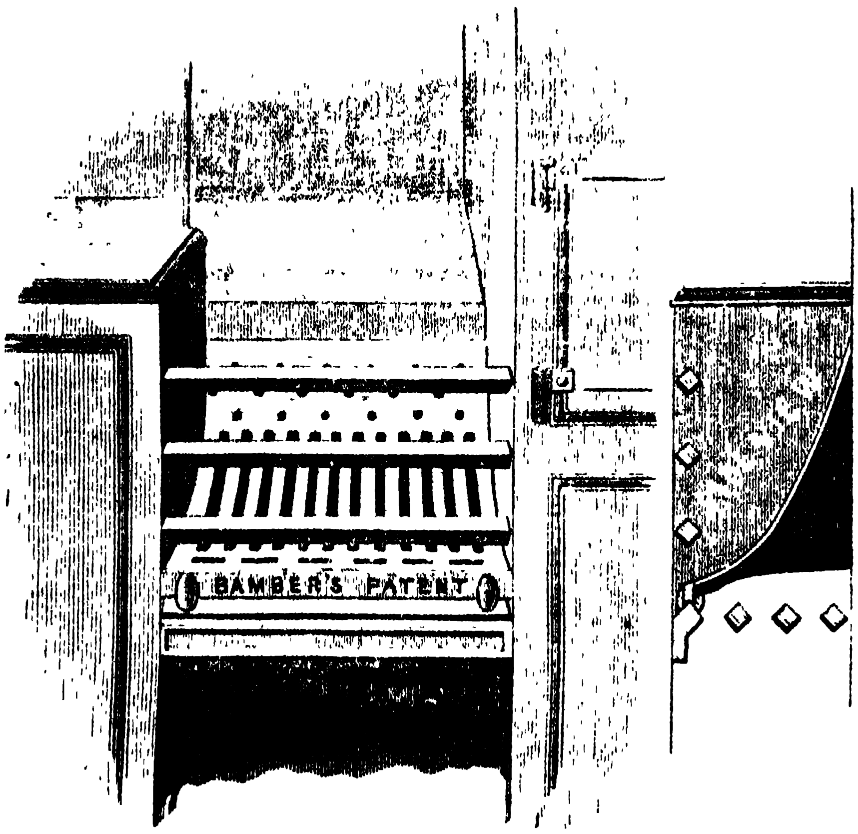
"Tale of the Sea." By Gooch. Author, Custom House.

"Principal Forbes and his Biographers." By John Tyndall. Longmans.

"Workshop Appliances." By C. B. Shelley, C.E. Longmans.

CENTRIFUGAL PUMPS

A FEW months ago it was reported that Messrs. John and Henry Gwynne, of the Hammersmith Iron Works, Hammersmith, had commenced the construction of by far the largest set of centrifugal pumping machinery yet undertaken, this machinery being intended for employment on the reclamation of the Ferrara Marshes, in Northern Italy. The tract to be reclaimed extends over an area of nearly 200 square miles, and the work to be done by the pumps consists in raising a little over 2,000 tons of water per minute. The first part of these pumps with their engines have just been completed. Quite apart from their exceptionally large size these engines and pumps are as respects design and workmanship, perfect models of their class and some particulars of them will therefore be regarded with interest by numbers of our readers. It is a very simple matter to state that certain pumps have to raise 2,000 tons of water per minute, but it is more difficult to appreciate what such a performance really means; and we propose to state a few facts which will enable our readers to obtain a clear idea of the work to be done. Two thousand tons or 456,000 gallons per minute equals 656,640,000 gallons per day of 24 hours. According to the latest returns, the total quantity of water supplied by the whole of the London water works is a little under 110,000,000 gallons per diem, so that it will be seen that the quantity of water to be dealt with by the Ferrara pumping machinery amounts to six times the whole metropolitan water supply. Again, 456,000 gallons, or 72,960 cubic feet per minute, would supply a stream over 100 ft. wide and 4 ft. deep running at a speed of two miles per hour, or 176 ft. per minute, while the delivery for a single day would also suffice to fill a reservoir a mile square to a depth of about 3 ft. 9 in.



BAMBER'S PATENT COAL ECONOMISER

THIS Coal Economizer is an apparatus of the character illustrated by the engraving, which shows a kitchen-range with it applied thereto. An inspection of the side view (sectional) will clearly convey an idea of its construction, the white curved line showing section of the Economiser. This Economiser is adapted for kitchen-ranges, register, and sham register grates, being very simple, it can be easily applied. From being perforated, there is a continual current of air passing through the Economiser, which is at the back of the fire, hence the heat is thrown forward into the room instead of being carried up the chimney, as is the case with ordinary grates It is stated that it will save half the coal, and give more heat than an ordinary fire. Many of the hotels in the neighbourhood of Accrington, Lancashire, have their kitchen tables fastened to the floor to prevent them being knocked over, and generally they are fixed facing the fire; and, it appears, that in several instances the paint upon them has been blistered since the Economisers were introduced into the kitchen grate.

A very great advantage of this apparatus is that it is moveable Snugs at the bottom of the Economiser enable it to be fitted upon any of the front bars of the fire-grate (see side view). The engraving shows the position for winter, but as summer advances it can be raised from bar to bar for two or three bars, when there will only be a handful of fire for cooking purposes This not only saves the coal, but adds to the comfort of the household by regulating the temperature of the room. The annual consumption of coal for domestic purposes in Great Britain is computed to be over twenty million tons, but half that quantity would suffice if every household adopted economising apparatus. It appears the price for an ordinary cottage fire is from three to four shillings. Amongst the other merits of this invention it makes the fire-place present a clean and tidy appearance. The patentee and maker is R. Bamber, Accrington, Lancashire.

MR MACFIE, M.P., ON PATENT LAWS

THE following is Mr Macfie's reply to the official invitation from Vienna to attend the International Conference on Patents for Inventions recently assembled in that city —

House of Commons, 25th July, 1873.

Sir,—I have the honour to acknowledge your letter dated 21st inst, and I assure you I esteem highly the compliment of being specially invited to attend the Conference on Patents for Inventions, but I regret that I cannot accept this invitation My engagements here and in Scotland are decisive

I remember with pleasure conferences somewhat similar, at which I had the honour to be present, at Dresden and at Ghent. At the former of those places a congress of political economists declared itself opposed on principle to the monopoly system of rewarding inventors. At the latter, in the Congress of the International Association for the Promotion of Social Sciences, a vote was unanimously passed, on the basis of a paper of mine, in favour of an international system of dealing with inventions. If I were to express my opinions at your conference they would be found in substantial fundamental accord with both of these resolutions; for I think it obviously beneficial to any country subjected to patents that other countries which are its competitors in trade and manufactures should be liable to the same burdens and restrictions, otherwise they gain an unfair advantage—their freedom from restrictions and prohibitions, their exemption from "royalty taxes" or duties to the holders of patent rights, acts in their behoof very much, and indeed with aggravation, as a protective or differential duty on the productions of the country that is their rival. Such is the character and effect of royalties exacted by patentees. (When royalties are not accepted and the monopoly enforced, the protectionism of the patent system becomes prohibitionism.) But I am quite prepared to advocate liberal treatment of inventors. If any inventor proves by his success that his new act is a valuable contribution to society, I would gladly see him honoured and made the recipient of a sum of money. Let there be an international committee of the several States of the civilised world constituted to make these acknowledgments. A comparatively small pecuniary contribution by each State would suffice. Assume it to be what you will, I doubt not it would put more money into the pockets of deserving inventors and adventurous manufacturers than the existing system of granting (too promiscuously and without such discrimination as to make it creditable to be a patentee) what we euphonistically call "exclusive privileges," *i.e.*, a more than royal power to forbid one's fellows for fourteen years to make or use processes, or machines, or knowledge, which the course of Providence opens to view and brings within reach. As to the people, on whom ultimately the burden of patents falls, they would be immensely advantaged by the exchange of the present mode of "purchasing" new methods and arts for the simple and natural one of direct pecuniary contributions, based on accurate estimates of their worth, formed on the incontestable proof of value established by experience and actual use. No one country probably would be assessed in order to provide as its quota £100,000. Will any expert calculate how much—in royalties, in enhanced prices, in retardation of improvements, and in various directions which I need not follow out—the present system costs? Whoever does so may expect to find the result, reducing it to money, will reach several millions The British Government a few years ago appointed a commission, presided over by the present Earl of Derby, to inquire regarding patents. This commission indicated in its report that the question of the policy of granting patents deserves to be considered Since then the Commons House of Parliament appointed a committee on the subject of patents, one of whose recommendations was that there should be introduced into the patent system the principle of internationalism, as well as compulsory licences (*i.e.*, abolition of the monopoly element in grants of patents). I call your special attention to the evidence given to that committee by M. Schneider. The eminent "tradesman" and statesman sanctions by his weighty opinion the idea that the obnoxious system might be continued if much more of formality and rarity conditioned its future He would make patents quite exceptional favours, to be granted only in cases of special promise specially examined and adjudicated on. To this compromise few would loudly object. I hope the deliberations about to take place at Vienna will have mainly in view the welfare of society, allowing the interests of producers and consumers to predominate over the pretensions of ingenious contrivers who have hitherto, little to the advantage of many among themselves, been stimulated into unhealthy and destructive activity.

My friend Mr. Webster, Q.C., has kindly agreed to carry for you twenty copies of a compilation I made three years ago of arguments *pro* but chiefly *contra* patents as hitherto administered. Will you do me the honour to accept and circulate these?

I am confident that your conference will mark and institute an epoch, if it eventuate in arrangements such as will be found imperfectly sketched in this volume.

Again expressing the disappointment I feel at not being a sharer in your consultations, but anticipating therefrom such propositions as the British Government (in which a judgment adverse to patents begins to prevail, on the Woolsack, in the War Office, at the Treasury, and elsewhere) may hail as a practical steps towards solution of a great question hitherto not grappled with, and indeed barely considered as to its principle in most States of the civilised world,—I have the honour to be, Sir, your faithful, humble servant, R. A. MACFIE.

We learn that our friend and fellow-member of the Inventors' Institute, Mr. J. R. Cressy, is candidate for the office of engineer, &c., to Dartmoor Prison. We trust he will be successful, as he deserves to be.

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THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON

ESTABLISHED 1ST MAY, 1862

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LORD RICHARD GROSVENOR, M.P.

Chairman of the Council

SIR ANTONIO BRADY

NOTICES.

TO MEMBERS OF COUNCIL.

A meeting of the Council will take place on Thursday, September 4th, at 7 o'clock.

At the Office of "The Scientific and Literary Review," 21, Cockspur Street.

All Subscriptions should be paid to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W.

Proceedings of the Institute.

A meeting of the *Council* (ordinary) of the Inventors' Institute was held on the 14th August at the Office of the SCIENTIFIC and LITERARY REVIEW, 21, Cockspur-street, S.W., Mr. F. H. Varley, chairman of the Ordinary Council, presiding. A Report by Dr. R. H. Collyer, hon. Commissioner of the Inventors' Institute to the International Patent Congress at Vienna, was read. This Report was ordered to be printed and published. (See Report as printed in the present number of the SCIENTIFIC and LITERARY REVIEW.)

After this Mr. Carttar moved, "That the important questions raised by the results of the recent Congress at Vienna, render it probable that the patent laws will be much discussed at the forthcoming meetings of the British Association and the Social Science Congress; therefore it is desirable that a representative be sent by this Institute to those assemblies."

This was seconded by Mr. Murray, and carried unanimously.

It was also resolved, "That Mr. F. H. Varley and Mr. A. J. Murray be requested to attend the British Association as hon. Commissioners."

It was likewise resolved, "That Mr. Stretton, the receiver, be requested to take measures for supplying all paying members with official receipts."

It was also resolved, "That early payment be solicited from all members who have not paid up their subscriptions, and that Mr. Carttar (the Auditor) and the Secretary be specially charged with carrying out this resolution."

The following gentlemen admitted as,—were ordered to be placed on the List of,—Members, viz.:—Messrs. A. Sweet, Sofus E. Holten, J. Rochford, M.E., W. Mitchell, Jno. Robinson.

Monthly Notices.

The Tribunal of Commerce movement is, we are glad to say, still progressing; although, the present being no time for public meetings, no demonstration is on the *tapis*, but Mr. Francis Lyne, who might not be inaptly termed the father of the movement, has recently published a pamphlet treating the subject historically and suggestively.

As Dr. Joule, of Manchester, the President-elect of the British Association, will, unfortunately, be unable to preside at the forthcoming meeting owing to ill-health, Dr. A. W. Williamson, of University College, has been elected to the office, and will assume the presidency at Bradford.

L'Institut, for the 9th July, prints copious extracts from a note by M. M. P. Gervais, "Sur les Ossements Fossiles de Mammifères trouves jusqu'à ce jour dans les Différentes Parties de l'Italie." In the same journal, for the 16th July, will be found a curious and instructive paper on anthropology, read by M. de Bischoff before the Academy of Sciences of Munich.

M. P. Gervais publishes, in his own *Journal de Zoologie*, a paper, describing the animal remains which have been brought to light by M. E. Piette, during his exploration of the bone-cavern of Gourdan in the Haute Garonne. These remains consisted chiefly of the bones of the reindeer broken by man, and associated with the bones of a few other mammals, and of certain birds and fish. The cave has also yielded a curious collection of designs engraved on bone, by men of the reindeer period. One of the most interesting of these rude engravings is a figure representing a species of antelope, supposed by Gervais to be the Saiga, or *Antilope Tartarica.*

In *Les Mondes*, for the 10th of July, will be found an interesting contribution by M. Le Comte Marschall, à Vienne, "On Practical and Theoretical Science in Austria." This journal, for the 17th of July, is of an unusually miscellaneous character, but, nevertheless, interesting.

The Academy of Sciences of France, at the *Séance* for July 7th, proceeds to elect a correspondent for the Section of Anatomy and Zoology, to replace Prof. Agassiz, elected "*Associé Etranger*," M. Steenstrup, obtaining a majority of thirty votes over Mr. Darwin, was chosen,—to replace M. Pictet, Prof. Dana was elected; and to replace M. Pouchet, Dr. Carpenter, who obtained thirty-five "*suffrages*," Mr. Darwin obtaining twelve, and Mr. Huxley, one.

The *Comtes Rendus*, for July 7th, contains two papers on solar physics, "Sur la Constitution du Soleil et la Theorie des Taches," by M. E. Vicaire, and "Les Cyclones du Soleil comparés à ceux de notre Atmosphere," by M. H. Tarry. They are both of considerable interest.

The German African Expedition, which was wrecked on the coast north of the Congo River, has returned to Sierra Leone. Although most of the instruments were lost, the expedition intends to proceed to Congo, where it expects to meet Dr. Bastian, the late President of the Berlin Geographical Society.

On the banks of the Coorong, about six miles north of Salt Creek, South Australia, a remarkable petroleum district has been opened out. The country is said to be saturated with mineral oil, and, around a shallow lake, a strange deposit is found spread out upon the sand, which, from its resemblance to india-rubber, has been called in Australia "caoutchouc," which yields upon distillation both gas and oil in large quantities. This peculiar substance, which has received in this country the provisional name of "coorongite," has been thought by some to be an elastic bitumen, and by others to be the mycelium of a fungus. Mr. T. U. Scrutton has according to the *South Australian Register* of May 20th, lately returned from the Coorong, and he reports most favourably of the locality, not only for mineral oil, but for coal.

The well-known comet discoverer, Tempel, on July 3, discovered a new telescopic comet, which has been found by Herr Schulhof, of the Vienna Observatory, and by Mr. Hind, to be moving in an elliptic orbit with a period somewhat less than six years. According to Schulhof's ephemeris, it is now at its nearest distance from the earth, about eighty millions of miles, but has passed its perihelion, and is diminishing in apparent brightness. The news of its discovery was immediately sent to America by Atlantic Cable, and it was observed on July 5, at Clinton, N.Y., by Prof. C. H. F. Peters.

Amongst works recently published—which, although not suitable for regular review in our pages, are nevertheless of a character likely to interest many of our readers—are the "Life and Letters of James David Forbes, F.R.S. By J. C. Sharp, P. G. Tait, and A. Adams-Reilly. (Macmillan and Co.), and "The Eruption of Vesuvius in 1872. By Prof. Luigi Palmieri, with Notes by R. Mallet (Asher and Co). In the first of these works three authors give us the several distinct aspects in Forbes's life and work. "There was his work as a scientific investigator and discoverer; his work as an Alpine explorer, and, as far as Britain is concerned, the father of Alpine adventure, his work as a professor and a university reformer, lastly, his character as a man." It appears that Forbes, when only seventeen years old, sent, anonymously, a paper to Sir David Brewster, the late lamented President of the Inventors' Institute, which won his attention, opened to the youth the pages of the *Philosophical Journal*, and, shortly, led to a correspondence which lasted for several years, and no doubt did much to forward Prof. Forbes's position in the world of science. In Professor Palmieri's work on the "Eruption of Vesuvius, 1872," Mr Mallet seeks to prove the weakness of the chemical theory first advanced by Davy, and afterwards advocated by Dr Daubeny, and of the rival mechanical theory; and, in their stead, and upon an experimental basis, that all the phenomena of elevation, of volcanic action, and of earthquakes, are explicable as parts of one simple machinery, namely, the play of forces resulting from the secular cooling of our globe. As the globe solidified by cooling, the thin crust at first formed contracted more rapidly than the still liquid interior, and "tangential tensions" were brought into play, whereby the crust would be broken into fragments. As the process of cooling advanced, the contraction of the interior proceeded at a rate greater than that of the thickening shell, and, consequently, "the signs of the tangential forces" were changed. The tensions became pressures, the resolved vertical components of which are competent to produce elevations and depressions at the earth's surface. Mr. Mallet considers it possible that these vertical components may, even now, be working changes in the heights of mountain chains. Prof Palmieri notes as a phenomenon never before observed, singular explosions or external eruptions, which occurred in the body of the lava streams themselves. He considers these shew a power in the lava to form eruptive fumaroles. These external eruptions ended without producing cones or craters; or at any rate, such, if formed, were swept away by the lava current. On the chemistry of the volcanic ejectaments, the author finds that lead chloride (alone or associated with other metallic chlorides) is a constant ingredient of the sublimates from the fumaroles of lava. Calcic chloride also has been observed in considerable quantity.

The return of thirty artisans sent out by the Society for the Promotion of Scientific Industry, to report upon their respective trades as exhibited at the Vienna Exhibition, is announced. A volume of Reports is to be issued shortly. The expenses of eleven Birmingham men were defrayed by the Birmingham Chamber of Commerce.

Sir Charles Wheatstone has received from the French Society for the Encouragement of National Industry the great medal of Ampere, which is awarded every sixth year for the most important application of science to industry. The former awards have been made to De Lesseps, the engineer of the Suez Canal, to Boussingault, for his researches on agriculture; and to H Ste.-Claire Deville, for his process for manufacturing aluminium. Sir C. Wheatstone receives the medal for his varied applications of electricity.

Dr C W Siemens's lecture "On Smelting Iron and Steel," delivered last March, before the Fellows of the Chemical Society, is published, with illustrations, in the July number of the Society's Journal.

The *Comtes Rendus*, for June 30, prints an interesting paper, communicated to the Academie des Sciences by M Dufour, "On the Reflection of Solar Heat at the Surface of Lake Leman," which applies to the reflection of the sun's heat from the surface of the sea, and explains the often observed phenomenon of the scorching power of such reflected heat under certain conditions.

M. Tacchini also communicates some observations which appear to him to prove the existence of magnesium in the border of the sun, having, as he thinks, some relation to the number of protuberances.

Another essay on the late eruption of Vesuvius, entitled "Der Vesuv im April, 1872," has issued from the pen of Herr Heim, of Zurich, who happened to visit Vesuvius at the time of the eruption. A German edition of Palmieri's monograph has been brought out under Prof Rammelsberg's care.

The Fish Commissioner of the United States has transported from the Eastern waters to those of the West, across the American continent, a large number of living fish, in a car specially fitted for their transportation with tanks, so shaped that the water could not escape under any amount of shaking. Eleven varieties of fish, natives of the Atlantic, were thus removed to the coasts of California, with a view to the naturalization in the Pacific Ocean.

Prof Scheerer, of the Mining Academy of Freiberg, recommends, for the removal of phosphorus from pig iron during the puddling process, that chlorides of calcium and sodium in equal parts be fused together. This mixture is introduced into the puddling furnace in the proportions of about three times as much as the phosphorus contained in the iron. The phosphorus and the chlorides combine and it is removed in the slag.

The varying expansion of the F hydrogen line, under ordinary atmospheric pressure and the increased pressures of the atmospheres of the sun and Sirius, has been employed by Mr J. J. Lake to obtain a proximate idea of the mass of Sirius, which he estimates cannot be less than twice that of the sun.

M Janssen's method for photographing the apparent contact of Venus with the edge of the sun is worthy of description. The photographic plate is in the form of a disc, fixed upon a plate which rotates upon an axis parallel to that of the telescope. Before it is placed another disc, forming a screen, in which is a small aperture, in order to limit the photographic action to the edge of the sun. The plate which carries the sensitive disc has 180 teeth, and is placed in communication with an escapement apparatus actuated by an electric current. At each second the pendulum of a clock interprets the current, and the plate turns one tooth, so that at each second a fresh portion of the photographic plate is exposed. Thus, in as many seconds, 180 images of the sun and the planet can be obtained. When the series relating to the first contact is obtained, the plate is withdrawn and another substituted, which gives the second contact, and so on for the four.

MITCHELL'S PATENT SMITHY HEARTHS FOR GENERATING STEAM.

This invention consists in fixing the fire inside a boiler flue, similar to a Cornish boiler, with sliding doors, so that the smith can close all up and prevent, as much as possible, of the cold air from rushing in during the time he is heating the iron. When the flame has passed to the opposite end, it is then conveyed round outside the boiler, similar to an ordinary steam boiler; the steam is of course conveyed to the engine or other boiler, or used to drive a steam hammer. On the furnace of a vertical boiler can be made use of, to form the smithy fire, when constructed for the purpose without fire bars. In each case the tuyere iron must come through the side of the boiler to a suitable position to convey the blast to the fire when resting in the bottom of the flue. When the blast passes through 1½ in. tuyeres, and is used in the ordinary way, I calculate that as much steam could be raised as would on an average supply a 6 in steam cylinder at 70 lbs. pressure. Where a number of these hearths are connected together, the supply of steam would be much more uniform than where one or two only are required. Pipes containing water are also used if desired.

Further particulars and terms may be had by applying to the patentee, W. Mitchell, Strand-street Works, New Islington, Manchester.

AFRICAN EXPLORATION.

We learn from the *Times* that Sir H. C. Rawlinson has received a letter from Sir Samuel Baker, dated 2nd July, 1873. In it he states that he found the Bahr-Giraffe completely changed, thanks to the great labour he bestowed upon the work in 1871, its canals having turned into permanent channels of deep water, and the force of the stream having cleared away its sandy shallows, so that his twin-screw steamer of 108 tons passed through without any difficulty. He says there are now eleven steamers on the White Nile, and with honest cruising no slaver could escape. Sir S. Baker, adds, "The news of Livingstone's safety is most cheering" but says, "I am astonished at his account of an examination of the north end of Tanganyika that there does not appear to be any connection with the Albert Nyanza. Since I wrote to Sir Roderick (Murchison) the King of Uganda, M'tése, to whom I had intrusted the search for Livingstone, sent messengers to me at Faliko, saying that his men had been to Ujiji, and declared that Livingstone had left that place long before for the west side of Tanganyika, since which nothing was known of him. They also reported that three white men had been to Ujiji, but had returned. I wrote a letter to Livingstone which will certainly reach him if he comes north, and the King of Uganda will receive him kindly, and forward him to the Government station."

Another communication from Sir S. Baker, addressed to his brother, conveying similar information, has also been published.

The death is announced of Sir Francis Ronalds, F.R.S., formerly director of the Observatory at Kew. Sir Francis was well known for his labours in the advancement of electrical science and its practical applications. He was in the eighty-sixth year of his age.

Proceedings of Societies.

VICTORIA (PHILOSOPHICAL) INSTITUTE.

At a recent meeting of this Institute, Mr. C. Brooke, F.R.S., in the chair, the Rev. Dr. Ross, Colonel Drayson, R.A., and several other members were elected, and donations to the Library announced. Among the letters read was one from the Right Hon. W. E. Gladstone, expressing the great interest with which he had read the proof copy of Professor Kirk's paper on "Force," which paper was then read by the author, who had prepared it with the special object of supplying a concise and popular essay upon the present aspect of a subject which had been made the question of the day. Professor Kirk began with a criticism of the more common definitions of force, and proceeded to treat of it as a true phenomenon, arguing that every reality which reveals itself as existent must be so regarded. His aim was to reach the conceptions of movement in its origin, or of that in virtue of which motion, in every instance, has its beginning. The doctrine of molecules possessing force was discussed at length, and the molecular theory generally disputed. The correlations of strictly material affections, and also the correlations of mental affections were stated, but the correlations of material with mental affections denied. Professor Kirk argued that an impossible limit separated mind from matter, so that while their several affections were related they are never correlated - that is, they never passed into another, as material affections pass into material, and mental into mental. The result of this paper went to show that true force is that capacity of mind in virtue of which it produces motion. Force, energy, and all kindred terms, when applied to matter could truthfully mean motion only, and if accounted for, must be so by reference to force-originating mind. An animated discussion followed the reading of the paper.

At the last monthly meeting of the council of this institute, held at the rooms, 8, Adelphi-terrace, sixteen additional members were elected. It was announced that seventy-nine new members had joined during the past seven months, and the fourth issue of the People's Edition of the Annual Address had taken place. It was also reported that in accordance with a resolution passed at the previous meeting the institute had joined in the application made to the Government for adequate aid to the expeditions to observe the transit of Venus, more especially those so strongly urged by the Greenwich board.

INSTITUTION OF NAVAL ARCHITECTS.

The following gentlemen have recently been admitted Associates of this Institution:—Lord Henry George Gordon Lennox, M.P.; M. Charles Antoine, of Brest; Mr. C. P. Bailey, and Mr. J. Black, of the Constructor's Department, Admiralty; Mr. G. J. Cole, Earle's Shipbuilding and Engineering Company; Mr. George Duncan, Shipowner; Mr. Thomas Edwards, Constructor's Department, Admiralty; Mr. Alfred Elgar, of Mr. E. J. Reed's staff; Mr. John C. Kafer, Engineer, U.S. Navy; Mr John Littlejohn; Commander W. B. McHardy, R.N.; Mr. Thomas Phillips and Mr Frank Proctor, of the Constructor's Department, Admiralty; Professor J. M. Rice, U.S. Navy; Messrs. J. Richards and G. J. Richards, of Mr. Reed's staff; Mr. R. E. Skill, C.E.; Mr. John Smith, of Messrs. Smith, Fender and Co., Millwall; and Captain Philip Syvret.

Correspondence.

COMPULSORY PATENT LICENSES.

To the Editor of the Scientific and Literary Review.

Sir,—From the report of the proceedings of the International Patent Congress, sitting at Vienna, it appears that the sixth resolution proposed is to the effect, "That inventors should be required to allow their inventions to be used by other parties on payment of suitable remuneration." This is a proposition on the part of manufacturers inimical to the interests of patentees and the public.

Finding the idea of abolishing patents untenable, this proposition is next insidiously introduced to effect the same thing. It is the same idea disguised under a different garb. Its object is to disarm patents of their power to injure the trade monopolies which manufacturers at present possess, and remove the only impediments which obstruct the formation of one vast combined monopoly in manufacture. The only opposition and competition in trade with which manufacturers have now to contend is that arising from patented improvements in manufacture.

Under such a proposed law patentees would have to incur the expenses and risks of proving the value of their inventions, and in the event of their turning out to be of great value, then to be deprived of the profits to be derived from practically carrying them out and establishing lucrative businesses through their means, by which the real value of patents would be destroyed. Great risks will never be undertaken except under expectations of extraordinary gains. By this covert and unfair suggestion the risk of failure would fall upon patentees, while manufacturers would profit by their success. Factories for the manufacture of articles of merchandise are speculations of an entirely different character to those trading establishments devoted to dealing in their products. Merchants and traders deal in that which manufacturers produce, and, could a combination be formed amongst the general body of manufacturers, it would possess absolute control over the market prices of these articles of trade. The consequences resulting from such a state of things are fully exemplified in the present coal monopoly. Now the most effectual and only competition which manufacturers experience at present is that which springs from new factories established upon patented inventions of improvements in manufacture.

The implied condition of patents is that the inventions protected by them are of public utility. This utility is attained either by reducing the cost of manufacture, and consequently the market prices of its products, or by improving those products, or by producing something entirely new, or in some way or other accomplishing advantages beneficial to the public. These are the elements which give potency to trade competition created by patents in opposition to manufacturers, who would, but for such opposition, form a wealthy and powerful manufacturing monopoly. To give old established manufacturers, who possess unlimited wealth and world-wide trade connections, the same intellectual advantages as those possessed by inventors would effectually debar inventors, whatever might be the value of their inventions, from attempting to commence, or of even entertaining a thought of commencing, new factories upon the faith of patents in the face of such overwhelming oppositions. By combining unbounded wealth with all the inventive talent of the nation (the natural sequence of the proposed law) could only result, as before said, in the formation of one powerful monopoly in the manufacture.

To destroy the temporary and beneficial monopolies in patents would be *ipso facto* to create one of a permanent and highly pernicious character. This would be a public calamity, and one which would seriously affect the future welfare and stability of this Empire.

The suggestion is not only presumptuous, it is an attempted violation of the legitimate rights of property which can only be met by independent patentees by a decided protest.

Besides uniformity, simplicity and comprehensiveness in any code of International Patent Law, it is absolutely necessary that the system shall provide a prompt and summary process of a criminal nature to punish any wilful infractions of titles in such property. The notorious and scandalous administration of the patent laws may almost be said to be the only source of complaint which can be made against the patent laws of this country.—Yours, obediently,

A. J. Murray.

181, Albany-road, Camberwell,
August 9, 1873.

ABSTRACT OF PROPOSED INVENTION RIGHT BILL.

BILL PUBLISHED IN "SCIENTIFIC REVIEW" FOR JULY, 1871.

I. A chief commissioner (barrister) and six commissioners (technical scientific) to form Patent Commission.

II. Chief commissioner to have the powers of a judge of the superior courts, and may hold a court with like powers.

III. The commissioners under Act of 1852 superseded.

IV., V., VI. Provisions as to building offices, clerks, &c.

VII. Chief commissioner to make rules to come into operation fourteen days after laid before Parliament.

VIII. Seal of office provided for.

IX. *Certificates of invention right* to be issued by the chief commissioner, which shall confer for *twenty-one years* the same rights and privileges as the present letters patent.

X. Invention may be publicly recorded without charge when inventor gives it free to the public.

XI. *Application* for a certificate of invention right to be by declaration, and lodgment of a specification. Both to be registered.

XII. The invention may, after registry of application, during six months, be used and published, yet subsequent certificate to be valid.

XIII. *Amendments*, for four months after application of the specification may be made on payment of fees, subject to the approval of the investigating commissioner as being consistent with the original specification, and not interfering with the rights of others.

XIV. Fraudulent application, or any publication subsequent thereto, shall not invalidate the certificate granted to the real inventor.

XV. Advertising of applications provided for.

XVI. *Notices to proceed* to be given within four months after applications, same to be advertised, and objections to be allowed to be entered.

XVII. *Investigation* by a commissioner after notice to proceed, who is to report to chief commissioner.

XVIII. The investigation by the commissioner to proceed on comparison of the specification with opponent's descriptive statement, and *viva voce* evidence not to be received unless explanations are required.

XIX. Chief commissioner, after receiving the investigating commissioner's report, to investigate all matters relating to the application for certificate of invention right (except questions as to merit or utility of invention). Counsel to be allowed to be heard, but the cost attending their employment not to be allowed, unless the chief commissioner so

decide. Chief commissioner to decide the case as may be just and right.

XX. *If applicant persist in demanding a certificate of invention right, notwithstanding the objections of the commissioners*; certificate to issue, objections to be recorded. But no certificate to be issued when the chief commissioner decides in favour of objections made by others than the commissioners.

XXI. Validity of certificate of invention right after grant and before the confirmation, (provided for in the Act) may on demand be enquired into and adjudicated on.

XXII. No certificate of invention right to be rendered invalid on the plea of insufficiency of subject-matter merely.

XXIII. On adjudicating on the validity of a certificate, the chief commissioner may order it to be *cancelled*, but any person deeming himself aggrieved by such a decision may appeal to the House of Lords.

XXIV. Mode of determining and recovering the costs of an enquiry.

XXV. Patentees may surrender patents.

XXVI., XXVII. Specifications, amendments, abridgments, indexes, &c., be published.

XXVIII. "Register of invention rights," and XXIX., registration of proprietors provided for.

XXX. *Confirmations* of invention rights may take place *after the end of two* years and before the end of *three*. Applications for confirmations shall be advertised, and objections to such confirmations may be made within one month.

XXXI. Court for confirmation to consist of the chief commissioner and two other commissioners conversant with the particular subject-matter question. After due hearing decision as to confirmation to be given.

XXXII. *Indefeasible patent* after confirmation.

XXXIII. If confirmation be decreed, sealed certificate to be given, which shall be valid to the end of the 21st year from the date of application for certificate.

XXXIV. Fees to be paid at the end of every third year.

XXXV. Such fees are to be paid into the exchequer as part of the consolidated fund.

XXXVI. Parties guilty of infringement to be cited before the chief commissioner who shall hold courts of inquiry for the purpose.

XXXVII. A list of engineers, chemists, and others qualified to be select jurymen shall be kept, remuneration they are to receive to be regulated by the chief commissioner. Cases of infringement to be tried with five of these, or, if the parties desire it, with a common jury, provisions as to the proceedings of such courts.

XXXVIII. Official inspectors of infringements may be appointed.

XXXIX. Before confirmation of certificate, defendants in cases of infringement may plead against the validity of the invention right, want of novelty, prior use, or any other issues; but after confirmation only non-infringement.

XL. *Disclaimers* before confirmation may be entered.

XLI. Forms given in schedules to be annexed to Act to be used; but they may be varied by chief commissioner when occasion requires it.

XLII. Any person may apply to have an entry in the register of proprietors, by which he deems himself aggrieved, expunged, vacated, or varied; and chief commissioner may make an order to that effect, and also with reference to costs.

XLIII. The making a false entry in the register of proprietors, or forging a writing purporting to be the copy of any entry in said register, or tendering the same in evidence, to be a misdemeanour.

XLIV. Account of salaries, &c., to be laid before Parliament.

XLV. No certificate of invention right to prevent the use of an invention in any foreign ship or vessel.

XLVI. Certificate of invention right, for an invention patented in a foreign country, shall become void when the foreign patent expires.

XLVII. If the applicant for a certificate of invention right die before it is issued it may be issued to his representatives.

XLVIII. Lost certificate may be replaced by a duplicate.

XLIX. Within three months after any decision on any matter is given by the chief commissioner either party may appeal to the House of Lords.

L. Existing patents may, under certain conditions, be changed into a certificate of invention right.

LI. No money paid for royalty or otherwise shall be recoverable if certificate is cancelled.

LII. Chief commissioner may make an order for an injunction, inspection, or account.

LIII. Taxation of costs.

LIV. Allowances to persons holding appointments under the present patent laws.

LV. Interpretation clause.

LVI. No evidence shall be taken regarding anything affecting the validity of a certificate of invention right if it occurred more than fifty years before the date of said certificate.

LVII. This Act to be cited as "The Invention Right Act," and to take effect from—

LVIII. Time of commencement of Act; schedule of fees.

THE TRANSIT OF VENUS

AN able article on the discussions regarding the approaching Transit of Venus appeared in the recent number of the *Edinburgh Review*. Mr. Proctor has published some remarks upon it in the *Times*, which will scarcely, we think, be generally assented to by those who "can render a reason" for their opinions. He draws a somewhat amusing picture of an assumed understood (not expressed) compact amongst civilized nations, according to which England was to perform a certain part in the said Transit, and then laments that she has failed to act according to her proper position in this scheme. We believe, however, that the arrangements made will in all probability secure us a set of observations which, with the aid of those contributed by other nations, particularly the Russians, will fully and satisfactorily enable us to solve the noble problem (as it has been justly called) of the Sun's distance. These arrangements now include a commission to the *Challenger*, already engaged in scientific work, and therefore well equipped for such a purpose, to supplement her present labours by exploring some of the islands to the south-east of Kerguelen's Land, with the view of ascertaining whether there is any place at which a landing may be effected, and additional observations made for the application of Halley's method. No stone will therefore be left unturned for the efficient observation of the Transit in every practicable method. The Germans appear to place great reliance upon direct observations with the heliometer, and their well-considered plans for the use of this method deserve to be rewarded by successful results. Photography will also be extensively drawn into the service. The Americans in particular propose making great use of it; others also are to employ it, amongst them Dr. P. Kaiser, son of the late eminent Director of the Leyden Observatory, is to take charge of a Dutch expedition to Japan.—*Athenæum.*

MR. ROWLAND'S WEATHER FORECASTS.—A preliminary meeting was recently held at the chambers of Mr. J. R. Taylor, Weaver's-hall, for the purpose of hearing an address from Mr. Owen Rowland, on his improved system of weather forecasts, at which there were present Sir A. Brady, Mr. W. Darley, one of the Board of Trade assessors, Mr. J. R. Taylor, Mr. J. R. Rowland, and others.

(OFFICIAL REGULATIONS.)

LONDON INTERNATIONAL EXHIBITION OF 1874.

Division II. Classes 8 to 13.

MANUFACTURES.—Regulations for exhibiting manufactures, with the raw produce, machinery and processes employed.

(Rules extracted from the Directory.)

43. In 1874, Division II of the Exhibition will consist of the following classes:—

Class 8. Lace (hand and machine made).

Class 9. Civil Engineering, Architectural and Building Contrivances.

a. Civil Engineering, Architectural and Building Contrivances.

b. Sanitary Apparatus and Constructions.

c. Cement and Plaster Work, etc.

Class 10. Heating by all methods and kinds of fuel.

Class 11. Leather, including Saddlery and Harness.

a. Leather, and Manufactures of Leather.

b. Saddlery, Harness, &c.

Class 12. Bookbinding.

Class 13. Foreign Wines, in the Vaults of the Royal Albert Hall.

Under Division II. (Manufactures) will be exhibited selected specimens of the finished manufacture, as well as the raw material of the fabric in its different stages of production, and the machinery and processes employed in its manufacture.

44. All industrial objects submitted for exhibition should be limited to such specimens as are necessary to show the manufacture and patterns in a satisfactory manner. No mere duplicates can be admitted; the same design in a fabric may, however, be shown with different combinations of colours.

45. With the view of increasing the educational value of the Exhibition, by chronicling the progress of manufactures, Her Majesty's Commissioners will reserve certain spaces in the industrial division for special collections of ancient works.

46. In the case of industrial productions, the special reasons (such as excellence, novelty, cheapness, etc.) why it is exhibited should be stated, and, whenever possible, the average retail price at which it can be bought.

47. Exhibitors of machinery must construct all necessary foundations, and provide their own driving-belts and driving-pulleys, which are to be in halves, and bored to the proper diameter of the main shafting, as notified to them by Her Majesty's Commissioners. They must also supply and erect, at their own expense, any counter-shafting (including the necessary foundations) which they may consider requisite to increase or reduce the speed to suit their own particular machines.

48. In order that exhibitors of machinery and processes may recoup the cost of the operations illustrated, they will be permitted to sell to visitors such results of the operations as are actually manufactured within the Exhibition building, on condition of the payment of a moderate royalty, based upon a head-money payment on the total number of visitors to the Exhibition.

49. The following information should be supplied, with the form of preliminary application (No. 10), by proposing exhibitors of machinery (Form No. 10a).

a. A plan of each machine, showing the position of driven-pulleys, the minimum space required for attendants, and indicating the parts of the machine which should be placed most prominently for inspection by the public. An elevation would also be of use, if it could be supplied without inconvenience.

b. A plan and section of the foundations required.

c. The weight of the machine.

d. The amount of motive power, in actual horse-power, required from main shafting.

e. Should water, steam, or gas be required, all necessary information as to the quantities of the requisite supplies, which must be paid for by the Exhibitor.

56. Exhibitors must make their own connections for gas, water, and steam. They must also provide and attach meters of sufficient capacity to measure the quantities of gas or water which they may consume, and for which they must pay monthly to Her Majesty's Commissioners, at the rates actually charged at the time by the companies.

57. The latest days appointed for receiving the different classes of goods are as follows:—

Tuesday, 10th February, Specimens of Ancient Lace.

Monday, 17th (? 16th) February, Class 10 Heating by all Methods.

Wednesday, 4th March, Machinery of all Classes.

Thursday, 5th March, Class 9. Civil Engineering, Architectural and Building Contrivances.

Friday, 6th March, Class 11 Leather, Saddlery, and Harness.

Saturday, 7th March, Class 12. Bookbinding.

Tuesday, 17th March, Class 8, Machine-made and Modern Lace.

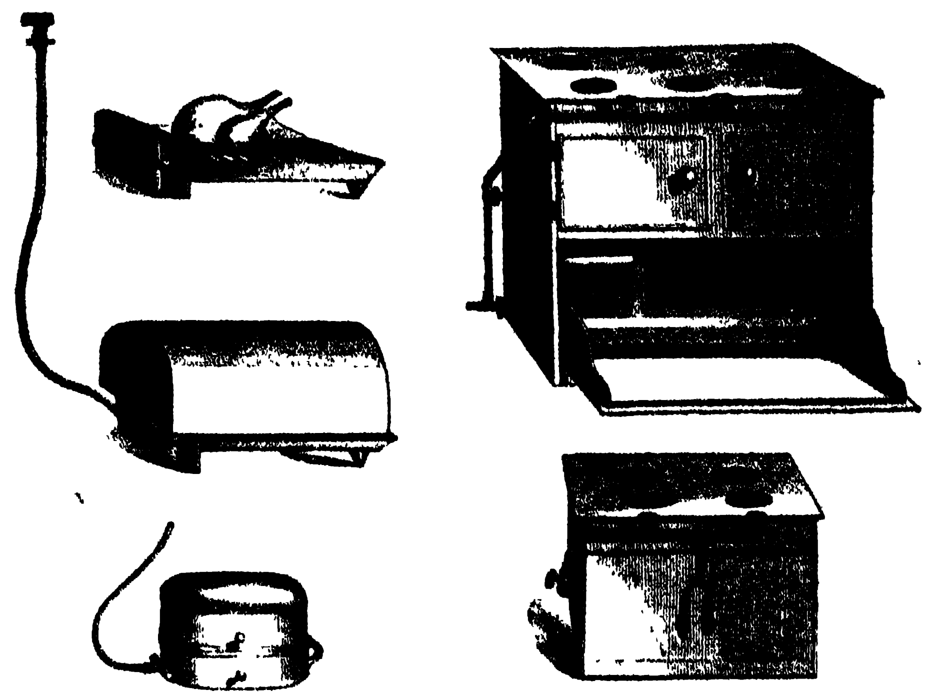
Foreign Wines (Class 13) must be delivered punctually on the days which will be announced hereafter.

58. Exhibitors in Class 9 who may wish to show new methods of construction in actual operation, during the Exhibition, will (with the Committee's approval) be allotted space in the West Annexe, wherein to build or to erect their plant, etc., in view of the visitors to the Exhibition.

7. Applications to submit objects, proposed for Exhibition, to the Official Committees of Selection, should be made on the Form of Preliminary Application (No. 10), which can be obtained at the Offices, 5, Upper Kensington Gore, London, S W., and should be forwarded to the Secretary before the 1st January, 1874.

THE LONDON EXHIBITION OF 1874, AND CITY GUILDS.—The commissioners having decided that civil engineering and building are to be prominently represented at the exhibition of 1874, have invited the Tylers and Bricklayers' Company to nominate three of their members to serve on a committee of advice and selection for this class, and the court of the company have selected Mr R. Moreland, Mr. John Young, and Mr John Bird for this purpose.

A COOLING AND CHEAP SUMMER DRINK.—Dr. Walter Lewis has prepared an excellent orangeade for the use of the clerks and messengers in St Martin's-le-Grand, and as a precaution against cholera the Registrar-General strongly recommends it for general adoption. Here is the prescription:—Sulphuric orangeade useful in cholera times. Concentrated compound infusion of orange peel, 3 ounces; simple syrup, 12 ounces; boiled filtered water, 4 gallons. Mix well and add 3 ounces of dilute sulphuric acid. The cost of this is about 4½d. a gallon, and there is no cholera in a hogshead of it. In the Post Office it has to a great extent superseded "raw water and bad beer." It is healthy and refreshing, and a wine-glass full taken with a tumbler of filtered water is one of the best and cheapest drinks that men can take in hot weather, and particularly in weather when cholera is in the air and in every drop of noxious water that we drink.



SOUTHBY'S ECONOMIC GAS RANGES.

THE principle of these economic gas ranges and roaster, as shown in the above illustration, differs from that of all other gas cooking apparatus, in that the gas is burnt in a chimney, the lower end of which is left freely open, while its upper end delivers a highly-heated current of air into the upper part of the vessel in which the articles to be cooked are placed, this vessel having no escape for the heated air except below the level of the articles to be cooked. Many advantages are claimed for this arrangement. 1st. The gas being burnt in a strong current of fresh air, the combustion is perfect. 2nd. The heated air escaping only at the bottom of the vessel instead of, as in other apparatus at the top, it is that portion which has given out its heat to the articles in process of cooking that escapes instead of the hottest and unused portion, thus producing a much greater economy of gas. 3rd. The meat always being cooler than the air by which it is cooked, it is surrounded by a descending current which, the exit being at the bottom, escapes freely, whereas if the exit was at the top it could only eddy round and round. This secures that the great bulk of the air admitted into the apparatus shall pass immediately over the surface of the meat, carrying away with it all the vapours given off as fast as they are produced, thus insuring the same perfect ventilation as before an open fire, and preventing any possibility of the disagreeable flavour of oven-cooked meat. An incidental advantage of the even temperature secured by having only a bottom exit for the air, is that all the space in the apparatus is available for cooking, and also makes it an unrivalled oven for baking pastry.

Much surprise has been expressed at the makers of this gas cooking apparatus choosing illuminating jets in preference to the atmospheric burners, for which greater economy is usually claimed; but they maintain that the former have great advantages, at the same time for cooking purposes they are equally economical when properly used. Atmospheric burners of all kinds are liable to be lighted inside the mixing chamber, producing acroline smoke and various other noxious products of imperfect combustion. The simple union jet is free from this objection; and, as they contend for the economy, a given amount of gas burnt freely in air must produce exactly the same amount of heat, for as long as the ultimate products are water and carbonic acid, only the same amount of oxygen can have been used, and the same amount of heat developed, the only difference being that in the atmospheric burner the carbon and hydrogen are both oxidised simultaneously, whereas in the illuminating jet the hydrogen burns first, intensely heating the particles of carbon, which thus become luminous, and are then perfectly oxidised as they come in contact with the air at the surface of the flame. The result of this is that the total heat developed is the same in both cases, for the same amount of gas consumed, but whereas the hot gases produced by the air burner will only radiate about one-tenth of their heat, the rest being in the form of highly heated gaseous matter, in the other about one-half the heat is developed in each form. If, therefore, the radiated heat is allowed freely to dissipate itself a larger portion is lost when illuminating jets are used, but if, as in this apparatus, the jets are surrounded by a chimney, so that the radiated heat cannot escape, the results would be the same in both cases in producing the comparatively moderate temperature required for cooking.

The patentee is A. G. Southby, Esq., and the manufacturers are the Economic Gas Range and Roaster Company, 2, Bassett-street, Kentish-town, N W.

APPLICATIONS FOR PATENTS

CONTINUED FROM PAGE 138.

lantern.—W R Evans. Repeating fire-arms. (Complete specification)—H. Skoines. Manufacture of charcoal, black lead, lampblack, blacking moulders' oxydising black, black paint, and black japan from coke and other residues from the manufacture of gases used for illuminating purposes, carbonized from coking and cannel coal, shale, bitumen, or any oleaginous substances.—W R. Lake. Machinery for drilling or perforating rocks and other hard substances (com.)—W. C. Alldridge. Collar studs, solitaires, sleeve links, and other like dress fastenings.—N Lloyd. Obtaining heat for heating steam boilers, and for other purposes, and apparatus used for that purpose.—G Zanni. Magneto electric Morse ink printing telegraphic apparatus.—E. Tweedale. Flyers for roving, slubbing, and other frames.—H. Lake. Locking or securing the movable points of railway bars or the switches of railways. A. M. Clark. Steam and hydraulic breaks (com.)—G. Haseltine. Watering columns for railway water tanks (com., Complete specification.)—A V Newton. Propellers for canal boats and other vessels, and condensers for use in connection therewith (com.)—J Petrie, jun. Machinery for scouring or washing and drying wool and other fibrous materials.—W J. Hemmer. Reaping and mowing machines.

On July 1st.—2274 to 2282.—G. H. Dana. Manufacturing middlings flour (com.)—J. Whipp and W. W. Mellor. Tools for cutting or fracturing glass.—F. Cole and R. G. Acton. Using air as a motive power.—J. Spear. Flower-pot covers, window blinds, mats, kettle holders, and other like articles.—S. Dunn. Liquid for destroying vegetable life and checking its development.—J. Sturgeon. Machinery for compressing air.—H. H. Withers and J. Batchelor. Reaping or mowing machines, and the mode of tieing or binding into sheaves or bundles the corn or other produce cut thereby.—L. Chapman. Rotary pumps (Complete specification.)—W. Whitehouse. Apparatus for loading hay and other crops into waggons.

On July 2nd.—2283 to 2302.—E. Entwistle. Railway signals.—G. Haseltine. Looms for weaving (com.) (Complete specification.)—W. T. Wheatley. Fastening tires on wheels.—J. Roberts. "Proofing" felt hats.—G. Haseltine. Safety attachment for reaping and mowing machines (com.) (Complete specification.)—M. Pearson. Means or apparatus employed in fancy or figure weaving.—J. Combe. Machinery for winding cops.—O. Pritchard. New optical instrument for producing designs for art manufactures and other purposes.—S. Bidwell, J. Bidwell, and A. Bidwell. Tooth-brushes.—W. R. Lake. Apparatus for printing carpets and other similar fabrics (com.)—W. R. Lake. Manufacture of carpets and other similar fabrics (com.)—W. R. Lake. Manufacture of carpets, particularly applicable to carpets with a pile surface (com.)—J. Friedlander. Printing surfaces called "spongography."—J. H. Johnson. Inkstands (com.)—M. Rae. Treatment of finely divided iron ores, iron sands, or mine dust, with a view to smelting the same in blast furnaces.—J. A. Wade and J. Cherry. Carts.—H. Smith. Cartridges for breech-loading fire arms.—R. Boby. Machinery for separating or sorting seeds.—F. Wilkinson and J. Elce. Machinery for spinning and doubling cotton and other fibrous materials.—W. R. Lake. Processes for plating iron, steel, and other metals with nickel (com.)

On July 3rd.—2303 to 2313.—G. Heywood and J. Duckworth. Boiling kiers employed in the cleansing or treating of woven fabrics and other materials, applicable in part to other descriptions of kiers.—E. Dwyer. Self-acting couplings for railway carriages and engines.—H. A. Bonneville. Steam engine brakes (com.)—C. Wood. Manufacture of bricks or blocks from granulated slag, and apparatus for that purpose.—B. Giles. Apparatus for heating water.—C. Hide. Process for protecting, finishing, and ornamenting walls and buildings.—J. A. Emslie and J. T. Emslie. Tell-tales and machinery therefor.—M. A. F. Mennons. Direct application of moving force (vis viva) to the propulsion of locomotive, marine, and other movable engines (com.)—G. Haseltine. Apparatus for distilling and barrelling turpentine and bleaching resin, and for other like purposes (com.) (Complete specification.)—W. J. Schlesinger. Tap for drawing champagne, lemonade, and other liquids from their bottles (com.)—S. R. Bamford. Cheese-making machines.

On July 4th.—2314 to 2329.—H. B. Barlow, jun. Machinery for washing and dyeing fibrous materials (com.)—J. B. Sutton. Self-acting lubricators for shafting and other bearings.—H. Bradley. Mode of preparing and printing designs or objects on metal or other surfaces by the agency of photography, such designs or objects so produced to be made permanent by the subsequent operation of the engraver, for the purpose of copper-plate or letter-press printing.—J. Marsden and J. Collins. Treatment of sewage water, and in the manufacture of manure.—J. Haithwaite. Apparatus for extracting chlorine from chloride of lime.—H. A. Isaacs and J. M. Isaacs. Addition to vessels or receptacles for edible substances.—F. Wirth. Washing machines (com.)—W. Peel. Looms for weaving.—J. Wulff. Fastener, chiefly designed for shoes, gloves, and other like articles (Complete specification.)—J. C. Mewburn. Machinery for spinning and twisting or doubling fibrous materials (com.)—F. H. Varley and E. Furness. Couplings and appliances connected therewith.—W. Inglis and J. F. Spencer. Steam engines.—J. F. Spencer. Steam engines.—A. Browne. Electro-telegraphy (com.)—J. H. Apted. Breech-loading fire arms.—J. Hartley. Wrought, welded, rivetted, or other boilers for hot-water heating apparatus.

On July 5th.—2330 to 2339.—J. Wheeler. Buttons or fastenings.—A. Browne. Sheet-metal boxes adapted for matches, sandwiches, soap, pens, and other purposes to which such boxes might be applied (com.)—C. D. Young. Ice boxes for the artificial production of solid and transparent ice (com.) (Complete specification.)—J. Pereira. Apparatus for the prevention of fraud on tramways and other lines of transit.—T. B. Armitage. Disintegrating wood or woody fibre and reducing the same to pulp. (Complete specification.)—A. Browne. Manufacturer of ferro-manganese and other metallic alloys, and apparatus for that purpose (com.)—T. Hydes and J. E. Bennett. New material for building purposes.—J. Wotherspoon. Closing the joints of gas retorts and means employed therefor.—E. J. Grocy. Rotary engines.—R. W. Grice. Manufacture of gas and coke.

On July 7th.—2340 to 2349.—J. Friedlander. Printing called "Moeller's printing press" (com).—C. C. Cramp. Improved car, which may be used with steam or other motive power, for tram or railways.—H. A. Bonneville. Fluid meters (com). (Complete specification).—F. R. Hoghton. Treatment of deafness, styled "the invisible electro-galvanic sound conductor."—W. Blundell. Apparatus for irrigating, sponging, syringing, and administering injections and douches to the human or animal body.—W. Davis. Springs for fixing the pullies of window blind cords, also applicable to other purposes.—D. S. Brown. Means of obtaining motive-power.—C. L. Van Tenac. Optical instrument, intended for the magnified projection with their natural colours of all opaque objects of small size.—A. V. Newton. Cartridge boxes (com.)—A. V. Newton. Machinery for sewing books and pamphlets (com).

On July 8th.—2350 to 2368.—A. M. Clark. Railway brakes (com.)—J. H. Smith. Sewing machines.—W. R. Campbell and J. W. Parker. Gas burners for use in street lamps, offices, public buildings, and all places where gas is consumed.—G. Haseltine. Preparing hides and skins for tanning (com.) (Complete specification.)—G. Haseltine. Rotary engines (com.) (Complete specification.)—W. R. Lake. Spark catcher for steam boilers (com.)—J. Shepherd. Machinery for manufacturing gas retorts, sanitary tubes, or other similar plastic forms.—W. R. Lake. Baking ovens (com.)—W. R. Lake. Apparatus for printing yarn (com.)—B. Hoffmark. Driving belt (com.)—L. Binns. Machinery or apparatus to be employed in the manufacture of endless bands, cords, or ropes.—W. Simpson and J. A. Simpson. Machinery or apparatus for the manufacture of fuel from fibrous materials, such as peat, spent tan, and other fibrous refuse.—M. A. Soul. Reefing sails (com.)—T. Cain. Hollow bars for furnaces or fire grates.—J. B. H. Howarth. Natural phosphates for the purpose of obtaining what are commonly called artificial manures or fertilizers, and apparatus connected therewith.—J. Worral. Apparatus for dyeing cloth.—J. H. Johnson. Gratings for protecting windows, doorways, and other apertures in buildings (com.)—R. M. Wanzer. Apparatus applicable to sewing machines (com.)—E. P. H. Vaughan. Obtaining and applying motive power (com.)

On July 9th.—2369 to 2379.—J. Dougall. Collecting fares or payments in tramway cars, omnibuses, and places of public resort, or at other places where payments are made, and apparatus employed therefor.—R. Lee, junior. Boilers for generating steam, also for horticultural and domestic purposes.—J. Mayer. Thermometrical apparatus for clinical and other uses.—Rev. J. E. Hardgraves. Construction of horticultural bed or frame for preserving or forcing fruits, vegetables, or flowers.—H. Moore. Steam engines.—W. E. Newton. Manufacture of semi-steel, and of railway bars composed partly of wrought iron and partly of semi-steel (com.)—S. W. Torrey. Preparing textile fabrics, india-rubber, gutta-percha, and other like materials to preserve them from decay.—F. T. Schmidt. Apparatus for the stoppage of a loom on the failure or breakage of a warp thread or threads.—J. Ducomet. Machine for manufacturing nets (com.) (Complete specification.)—J. H. Johnson. Reaping machines (com.)—H. D. P. Cunningham. Means and appliances for working heavy projectiles.

On July 10th.—2380 to 2389.—F. Wirth. New condensation steam engine with variable expansion direct from the regulator (com.)—H. Muir and J. Caldwell. Steam steering engines.—D. I. Urquhart. Preventing accidents in the shafts of mines, and machinery or apparatus employed therefor.—E. T. Hughes. New woollen fabric (com.)—A. Croft. Machinery and apparatus for dyeing skins and leather.—J. Hunt. Preparing peat or peat earth.—A. C. Moffatt. Machinery for serving or covering wire, and for such like purposes.—D. Pidgeon and W. Manwaring. Harvesting machines.—H. E. Newton. Combined sail and marine drag for boats (com.)—F. Curtis. Machinery for cutting diamonds or other gems (com.) (Complete specification.)

On July 11th.—2390 to 2402.—W. Macrone and W. Mackenzie. Stereotype plates.—J. Wotherspoon and W. Foulis. Lids or covers for retorts, and improvements in making the joint thereof with the retorts.—W. Wilson and H. Burch. Mowing and reaping machines.—X. Buquoy. Dredging machines or vessels (Complete specification.)—H. F. Nicholl. Carriage springs and the mode of adapting the same to wheeled carriages.—W. E. Gedge. Overseaming and embroidering machines (com.)—W. E. Gedge. Use of heated gases and of steam, whether superheated or not, applicable to all kinds of motive-power engines, and ensuring great economy of fuel with other advantages (com.)—A. G. Speight. Boxes, canisters, dredgers, cartridges, and other similar articles.—C. Avery. Teeth gearing for horse power and other purposes.—H. Robertson. Saddles.—W. A. Comber. Spanners or wrenches.—C. E. Spagnoletti. Working railway signals by electricity.—G. Stapleton. Apparatus for signalling or communicating in railway trains between passenger and guard and guard and engine driver.

On July 12th.—2403 to 2414.—B. G. D. Cooke. Waggons for carrying and discharging minerals and other substances.—J. Robinson. Machinery or apparatus for charging and discharging retorts, ovens, and furnaces.—S. Reynolds. Snap or portable connectors for harness and other useful purposes where a metallic portable connector may be required.—A. Ray. Siphon set in motion by insufflation suitable for decanting any kind of liquid (com.)—E. Moldrum. Manufacture or production of paraffine oil.—T. Lees and G. B. Ward. Apparatus for curling the brims of hats.—S. Alley. Multiple lubricators for machinery.—J. Kyle. Apparatus for the manufacture of ice.—J. C. Mewburn. Preserving wood (com.)—P. A. Gaillon. Casks and the machinery employed in making the same.—A. M. Clark. Manufacture of sugar (com.)—P. A. Gaillon. Building or contructing houses and other structures, and the materials employed therefor.

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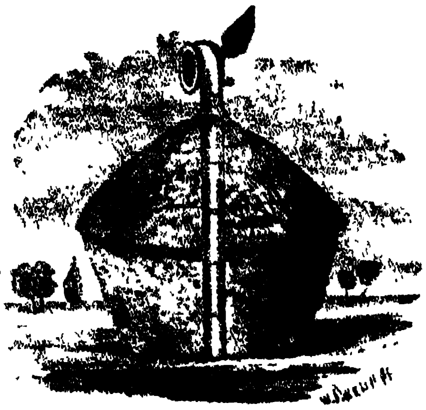

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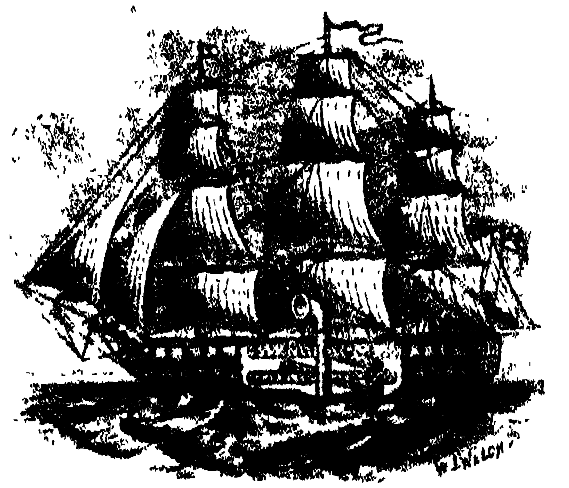

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. *Communications to the Editor to be addressed to him at 21, Cockspur Street*

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APPLICATIONS FOR LETTERS PATENT

. In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur street, Charing Cross.

On July 14th.—2416 to 2431.—W. H. Gillespie. Instantaneously arresting the motion of tramway cars.—R. Rapp. Apparatus for the manufacture of cardboard and paper pulp from vegetable plants and filamentous and fibrous shrubs. (Complete specification.)—W. May. Metal boxes or cases, and machinery for manufacturing the same and similar articles.—F. Cole. Crushing and reducing to impalpable powder barytes, cocoa, refined sugar, and similar substances, both vegetable and mineral.—P. Salmon. Steam boilers and gas apparatus, and gas engines and boilers, and apparatuses connected therewith, to warm, ventilate, light, signal, and break in or on railway carriages and other vehicles.—A. M. Clark. Improved tooth brush (com.) (Complete specification.)—W. H. Baxter. Self acting, weighing, and measuring machines and apparatus connected therewith.—W. Hackney. Ingot moulds for casting steel and other metals.—E. L. Macdonell. Apparatus to be attached to railway trains for the purpose of preventing or diminishing the effects of collisions, and thereby promoting the safety of the public travelling on railways.—J. J. Richardson. Machinery or apparatus for manufacturing hackle, gill, card, or other pins and teeth used in machinery for preparing woollen, cotton, flax, or other fibrous substances.—F. J. Fahlman. Apparatus applicable to closets and portable commodities.—T. H. P. Dennis and C. Lattway. Glass orchard or green-house.—A. M. Sillar. Construction of burners for the combustion of gas.—M. Mathews. Method of and apparatus for producing watermarks upon paper.—J. Ellison. Machinery or apparatus for crushing or breaking stone, ore, quartz, or other hard substances.—C. M. Phelps. Printing telegraphs.—J. P. Warner. Manufacture of trimmings.

On July 15th.—2432 to 244[illegible].—G. Whight. Railway rails and spikes for securing the same, and for other like purposes (com.).—G. Whight. Grate-bars for steam boilers and other furnaces (com.).—F. P. Warren. Cooling the interiors of railway carriages and other vehicles, and apparatus and arrangements for the purpose.—R. A. Fisher. Preventing incrustation from wasting away by oxidation, corrosion, or other causes, thereby preventing incrustation in steam boilers and water tuyeres. (Complete specification.)—H. Swonnell. Heating malt kilns.—J. Jabot. Cooking apparatus.—J. H. J. Jonson. Steam washing apparatus (com.).—A. P. Donisthorpe, G. E. Donisthorpe, T. A. W. Clarke, W. H. Snowden, and H. Dearden. Manufacture of mixed yarns of

vegetable and animal fibres.—L. Gye Fire-arms.—W Wonnald and E Dobson Sewing machines.—F Kurtt. Treating sewage and other foul liquids, also partly applicable to bleaching and other cleansing operations.—T Tinsley Self-feeding copying brush with reservoir handle (com.)

On July 16th.—2444 to 2463.—H Hewitt. Pen-holders.—E. J. W Cooke and J. L. Emary Construction of telescopes, microscopes, cameras, and other optical instruments.—S E. Holten and F. H Varley. Counting, indicating, and signalling apparatus, partly applicable to horological instruments. P. Wilson. Double-drill plough, parts of which are applicable to other agricultural machines.—R U Etzensberger. Apparatus and arrangements for making infusions or extracts from substances.—W Weldon Absorbing dilute chlorine, and apparatus for that purpose.—F. C Hamilton and W R Preston Manufacture of artificial manures.—E. Helm Looms for weaving.—R Harwood, G. Harwood, J Scholes, and T Seymour Flues of steam boilers for effecting the economy of fuel.—J Somerville and J Robinson. Apparatus for discharging gas retorts. F. Jacobson Clarification and purification of sewage and the discharges of polluted waters from paper mills, printing works, dye works, and other factories by means of precipitation.—F Jacobson Clarification and purification of the polluted discharges from paper mills, printing works, dye works, and factories by means of precipitation. N S Walker Bale tie or buckle. P R de F d'Humy Inkstands.—T F. Lynch Infants' feeding bottles and caps or covers for the same. J W Meyer. Printing machines. S Thompson Ice preservers or refrigerators. J H Johnson Injectors for feeding boilers (com.)—B F Weatherdon, Hon. L. Colborne, and F L. Barrington Self-acting machinery or apparatus to be employed conjointly with a certain motive power for propelling ships and other navigable vessels, or for similar purposes.—J Hickson Teats, rings, and other articles sucked by infants.

On July 17th. 2464 to 2471.—I Bradley. Manufacture of solid headed metallic cartridge cases (com.)—P R de F d'Humy. Tea or coffee caddies or canisters.—H Bezer Means and apparatus for registering the distance travelled by each person in any vehicle, the distance passed over by the vehicle itself, and the time occupied by the journey.—W. A Lamb Floating docks or apparatus to facilitate the repairing of ships or vessels.—J. H. Banks. Production of printing surfaces and of engraved metal surfaces, applicable for other purposes.—P Gamboni Apparatus for producing and maintaining motive power, or assisting to produce and maintain such power. E. G Wright Apparatus for cutting or reducing brewers' linings, applicable for other purposes.—J A Muller Apparatus for measuring and registering the flow of water and other liquids.

On July 18th. 2472 to 2480.—A Gow. Manufacture of bichromate of potash, or salts of similar commercial properties.—W R Harris Means for facilitating the formation of wheel segment and rack patterns or models, or the production of toothed wheel segments and rack castings.—G Monro and R. C Le Mesurier Process of engraving on metal plates in relief. D O Macomber Rendering wood uninflammable.—W Webster Flat irons. B J B Mills Carding engines, part of which improvements is applicable to other machines for combing fibrous materials (com.)—J Poole Billiard or dining tables, also suitable for other tables, bedsteads, or purposes requiring varied heights. J. H. Johnson Treatment of peat, and the machinery or apparatus employed therein (com.) W. H. Thomas. Refrigerating apparatus applicable for preserving food and other purposes.

On July 19th.—2481 to 2498. F. P H Vaughan, F.C.S. Construction of tuyeres or nozzles for blast furnaces, and the mode of fixing the same (com.) (Complete specification.)—D. C. Knab. Mode of utilising all the products of distillation of combustible, vegetable, and animal matters in the production of gas.—S. H. F. Cox Apparatus for separating from each other matters of different densities or specific gravities.—A de S. A. e C. C. de Penamacor, A. P. de S e Castro, and T. S Hopcraft. Production of citric acid, tartaric acid, and alcohol.—G Sirtaine. Method of cleansing wools from burrs and seeds, and for the disintegration of vegetable matters generally.—J. H Johnson. Obtaining motive power, and the machinery or apparatus employed therein (com.) J H Johnson Manufacture of steel (com.)—F Harrison Cement for joining leather, wood, china, glass, and other articles.—M Clark Drying stones employed in the manufacture of turkey-red yarns and woven fabrics.—A Hogue Steam engines.—C L Layard. Gas burner with lateral and external jets.—J Russell and G Downey Appliances for winding and preserving velvet and other ribbons, lace, trimmings, and other like articles.—J H. Carey and A. W Turner. Steam engines.—F Wirth Slide and cylinder-lubricating apparatus for locomotives and steam engines (com.)—E R Cogswell. Life preservers.—W. R Lake Machinery for spinning wool (com.)—H Kesterton Construction of steam boilers.—J L Clark and J Standfield Hydraulic apparatus.

On July 21st. 2499 to 2503.—T R Harding and F W Harding Machinery for pointing wire used in the manufacture of needles, pins card or heckle teeth, and for other purposes. A Neumcke [illegible] or apparatus for cooling worts. J Smith Cards used for clothing the carding cylinders of carding engines (com.) A J Eastwood and R Ainsworth Machinery for cleaning the surface of cloths and hides. C G. Wheeler Apparatus for distributing water and regulating and controlling the passage of fluids through pipes or tubes.

On July 22nd. 2504 to 2512.—J [illegible] New and useful mechanism for spreading silk. (Complete specification.) J Corey, J. G Rowson, and J Price Apparatus to be used in connection with rotary puddling furnaces. J Loray Rock drilling apparatus (com.) F Rowan Manufacture of floor cloths, table cloths and other cloths. S C Lister. Combustion of fuel. J H. Wilson Spring scrapers for cleaning boiler and other tubes.—P Thomasson Manufacture and forging of railway and other carriage axles, and machinery therefor.—W. E. Newton. Steam generators (com.)—G. P. Spooner. Coupling and buffing apparatus for railway carriages.

On July 23rd.—2513 to 2523.—M. Mackay. Composition or compositions to be applied to the insides of casks and others vessels. E. Bacon, jun. Bottles.—M. V Jones. Screw propellers. J Arnold Manufacture and material for bandages, padding, bedding sheets, padding for splints, for splints themselves, and for other purposes.—G. Tidcombe. Means or apparatus employed in the manufacture of paper.—C Hodgson Sustainers for sashes, doors, sluices, and other similar sliding bodies.—C C Wyllie Application of a new material to the manufacture of paper.—H. Rett. Machinery or apparatus for hoisting building and other materials, or for raising and lowering heavy weights.—H Hathaway. Construction of furnaces.—H W Pendred Means or apparatus for regulating the action of screw shafts, and for preventing breakage or damage to the engine or its appendages from "lash."—F G Fleury. Domestic refrigerating apparatus for making ice and other purposes.

On July 24th.—2524 to 2533.—R. Nicholson Machinery or apparatus for charging and discharging gas retorts, and apparatus connected therewith. F. W Stoker Manufacture of rolls.—J J Edmondson Sash and other weights. W. H St John Processes for purifying illuminating gas, and apparatus therefor. (Complete specification.) F W. Follows and J Bate Machinery for cutting and preparing gorse and other vegetable animal, and mineral substances. W Young Reaping and mowing machines.—J A McKee. Cruet glasses.—W A P. La Grove. Mechanical dancing toy.—W. White. Treatment of sewage and cesspool water.—W. Turner Machinery for spinning, doubling, and twisting wool, cotton, silk, or other fibres.

On July 25th.—2534 to 2545.—J Roby. Treating sewage and other foul liquids for the economical removal and utilisation of soluble and suspended impurities contained therein, and apparatus for the same.—J. Richardson. Superseding the use of privies and ash or dust pits, thereby preventing the escape of all noxious and offensive matter into wells, foundations, and dwellings, and avoiding the expense and unpleasantness of cleaning out the same.—P. R. de F d'Humy. Calendars or date indicators.—J. S. Mignot. Manufacture of twilled fabrics for covering umbrellas, sunshades, and parasols.—J. Cumming Apparatus for separating sheets of paper or other similar substances from a pile, and feeding or moving them into or through printing, folding, ruling, embossing, envelope-making, and similar machines, and for ruling or staining such substances.—W Ashton. Perambulators.—A Granville and F E Johnson. Treating cotton waste, hair, wool, and oleaginous seeds for the removal of oil or grease, also applicable for the same purpose to hides and skins, and in preparing the same for tanning, and for preventing mildew in cotton and other fabrics, and apparatus for such purposes.—E. Lord. Machinery for grinding and pulverising.—J. E. H. Andrew Machinery for twisting, rolling, and compressing tobacco and other substances.—T. A. Hedley. Manufacture, combination, and purification of gases for lighting and heating purposes, and the apparatus employed therein.—E W Main Sanitary safety valve for preventing the admission of foul air and gases into dwelling-houses, and their escape from common street sewers and drains. H B Greenwood. Method of and apparatus for applying electricity to locks for operating and securing the same.

On July 26th.—2546 to 2558.—C. J Spencer. Sleepers and fish-joints for permanent way of railways (com.)—H H Murdoch Combined machine for winnowing, cleaning, and sorting grit, grain, corn, and other seeds (com.) C. Brakell Apparatus to be applied to looms for weaving velvets and other pile fabrics for the purpose of cutting or forming the pile as the fabrics are being woven. J M Lambert. Manufacture of leather hose and other rivetted leather goods, and apparatus employed therein.—B J B Mills Apparatus to stop the motion of cages or beds down mines and other places, and on inclines (com.)—W Richmond. Construction of chaff cutters.—L. Baxer Construction of ships, and their mode of propulsion, for facilitating navigation and augmenting speed (Complete specification.)—J. Snowball. Signal wire compensator.—Sir S. Canning and E J. Mayor. Telegraphic apparatus.—T. B. Bishop. Attachments for sewing machines (partly com.)—F J. Pearce and C C. Pearce. Fastener for window sashes and casements.—W. R. Lake. Drying houses, rooms, or kilns (com.) J. G Tongue. Steam boilers, and apparatus for governing the action of throttle valves (com.)

On July 28th.—2559 to 2566. R Aytoun. Method of impelling or working railway trains.—J. G. Tongue. Steam engines and pistons (com.)—J. Scattergood. Railway spikes.—F. Rahles and J. D. MacKenzie Bells or bar-bells, and apparatus connected therewith.—B. Donnet. New loom.—T. Pickles, S. Smithson, and C. H. Pickles. Apparatus employed in dyeing fabrics.—H. Haliday. Buckle or clasp for braces, belts, garters, and any other band when soft material is used.—J. B. Dowdall. Apparatus for signalling to the driver or conductors of cabs, carriages, and other vehicles.

On July 29th.—2567 to 2576.—W. Leech. Method of preserving wood from the ravages of white ants and other insects by the application of certain chemical solutions (com.) (Complete specification.)—T Walker. Electrical apparatus applicable to telegraphy and other purposes.—S. Farron Construction of cocks or taps.—J. Cooke and George Hibbert Turbine water-wheels.—W. W De La Rue. Construction of rotating calendars.—A. V. Newton. Apparatus for filtering liquid and gaseous bodies, which apparatus is applicable to the washing of clothes and other fabrics (com.)—P. G. Brunton. Steam engines, partly applicable to pumps.—F. J. King. Separating zinc, copper, or other ores or materials from carbonate of iron.—J. Wotherspoon and J. Corey. Packing butter for preserving it during transport or when stored.—W. H. Davies and F. H. W. Higgins. Electrical telegraphs.

On July 30th.—2577 to 2589.—A. Jaynor. Pneumatic telegraphic apparatus for transmitting messages or signals for ships, hotels, and other similar purposes.—J. Horrocks. Furnaces of steam generators, which improvements are or may be also applicable to furnaces for other purposes.—J. Woodley. Means or apparatus for trussing casks.—T. Black. Valves for steam engines, and apparatus or mechanism connected therewith.—J. Stephens. Treatment of excreta,

(Continued on page 165.)

Scientific and Literary Review.

OCTOBER 1, 1873

BRITISH ASSOCIATION, 1873.*

The meeting of the British Association which has just terminated is perhaps most notable as one of those in which solid scientific work, rather than sensationalism, has been the order of the day. It is, nevertheless, noteworthy in regard to the suggestion made by the President in his opening address, that, in this country, special provision should be made for higher education in science (technical inclusive), distinct and separate from our ordinary universities and colleges. We joyfully hail this utterance of Professor Williamson's (the president), as a recognition of the claims of Technological Education and [illegible] such as we have been for [illegible] to bring to a practical solution; though we do not agree with the Professor in his views with regard to the [illegible] any great necessity for establishing separate universities or colleges for teaching abstract or high class science *per se*, for, on the contrary, we consider that men of science of the highest type should possess a very considerable amount of knowledge of every branch of human learning, hence to them a university career in the present sense of the term must, therefore, be advantageous. In fact, the special colleges are needed for the advancement of practical science by improving the operations of the workshop, and the mental and industrial education of our workers. In short, we want a somewhat similar system applied to [illegible] which [illegible] namely, training in special technical schools or colleges alone, or at option, of its combination with the ordinary university training. Viewing the proceedings of the British Association in this way, we have given them a place on our first page.

Proceedings of the Association.

At the meeting of the British association on Sept 18th at Bradford Dr A. W. Williamson, F.R.S., delivered the opening address as president. After alluding to the fact that, but for the ill health of Dr Joule, he would [illegible] a list [illegible] merely upon that occasion, he proceeded as follows:—"For a good many years past chemistry has been growing at a more and more rapid rate. I could not, if I would, give you to-night an outline of the chief newly-discovered compounds with the various changes which they undergo, describing each of them by its own name (often a very long one), and recording the specific properties which give to each substance its highest scientific interest. But I am sure that you would not wish me to do so if I could, for we do not meet here to study chemistry. I conceive that we meet here for the purpose of considering what this wondrous activity in our science means, what is the use of it, and what we can do to promote its advancement. Now, since the father of modern chemistry, the great Dalton, gave to chemists a firm hold of the idea of atoms their labours have been continually guided by that fundamental idea. Every chemist who is investigating a new compound takes for granted that it must consist of a great number of atom-clusters (called by him molecules), all of them alike, and each molecule consisting of a certain number of atoms of at least two kinds. One of his first endeavours is to ascertain how many atoms of each kind there are in each molecule of the compound, and I want to draw your attention to the reasoning by which he judges of the value of the experiments when they agree among themselves, and to the meaning which he attaches to their result. If the result of his experiments does not nearly agree with any atomic formula (that is, if no conceivable cluster of atoms of the kinds known to be in the compound would on analysis give such results as those obtained), the chemist feels sure that his experiments must have been faulty—either the sample of substance which he worked upon contained foreign matter, or that his analysis was not made with due care. He sets to work again and goes on till he arrives at a result which is consistent with his knowledge of the combining properties of atoms. Every good analysis of a pure compound leads to results which approximate to those required by the atomic theory, and chemists trust so thoroughly to the truth of that guide, that they correct the results of such analyses by the aid of it. The chemical idea of atoms serves for two purposes: 1. It gives a clear and consistent explanation of an immense number of facts discovered by experiment, and enables us to compare them with one another and to classify them. 2. It leads to the anticipation of new facts, by suggesting new compounds which may be made, at the same time it teaches us that no compounds can exist with their constituents in any other than atomic proportions, and that experiments which imply the existence of any such compound are faulty. Numberless new compounds have been discovered under the guidance of the idea of atoms, and in proportion as our knowledge of substances and of their properties became more extensive, and our view of their characteristics more accurate and general, so were we able to perceive the outlines of their natural arrangement, and to recognise the distinctive characteristics of various classes of substances. Among the improvements of our knowledge of atoms which have taken place, I ought to mention the better evaluations of the relative weight of atoms of different kinds which have been made since Dalton's time. More accurate experiments than those which were then on record have shown us that certain atoms are a little heavier or lighter than was then believed, and the work of perfecting our observations is constantly going on with the aid of better instruments and methods of operation. But, apart from these special corrections, a more sweeping change has taken place, not in consequence of more accurate experiments interpreted in the usual way, but in consequence of a more comprehensive view of the best experimental results which had been obtained, and a more consistent interpretation of them. Thus the atomic weight of carbon had been fixed at 6 by Dumas's admirable experiments, and it was quite conceivable that a still more perfect determination might slightly increase or diminish this number. But those who introduced the [illegible] sweeping change asserted in substance that two of those supposed atoms, whatever may be the precise weight of each, always are together, and never separate from one another; and they accordingly applied the term atom to that indivisible mass of carbon weighing twice as much as a carbon atom had been supposed to weigh. So also with regard to other elements it has been shown that many atoms are really twice as heavy as had been supposed, according to the original interpretation of the best experiments. This change was brought about by what I may be permitted to call the operation of stock-taking. Dalton first took stock of our quantitative facts in a business-like manner, but the amount and variety of our chemical stock increased so enormously after his time that the second stock-taking absorbed the labours of several men for a good many years. One of the results of our endeavours to classify substances according to their natural resemblance has been the discovery of distinct family relationships among atoms, each family being distinguished by definite characteristics. Now, among the properties which thus characterise particular families of atoms, there is one of which the knowledge gradually worked out by the labours of an immense number of investigators must be admitted to constitute one of the most important additions ever made to our knowledge of these little masses. I will endeavour to explain it to you by a simple example. An atom of chlorine is able to combine with one atom of hydrogen or one atom of potassium, but it cannot combine with two at once. An atom of oxygen, on the other hand, can combine with two atoms of hydrogen or with two atoms of potassium, or with one atom of hydrogen and one of potassium, but we cannot get it in combination with one atom of hydrogen or of potassium solely. Again, an atom of nitrogen is known in combination with three atoms of hydrogen, while an atom of carbon combines with four of hydrogen. Other atoms are classified upon their resemblance to these respectively as monads, dyads, triads, tetrads, &c. The [illegible] value which we thus recognise in the atoms of these several classes has led us naturally to a consistent [illegible] the order in which atoms are arranged in a molecule. Thus, in the compound of oxygen with hydrogen and potassium, each of these latter atoms is directly combined with the oxygen and the atom of oxygen serves as a connecting link between them. Hydrogen and potassium have never been found capable of uniting directly with one another, but when both combined with one atom of oxygen they are in what may be called indirect combination with one another through the medium of that oxygen. One of the great difficulties of chemistry some few years ago was to explain the constitution of [illegible] compound those compound molecules which contain atoms of like kind and in equal numbers, but which differ from one another in their properties. Thus a molecule of common ether contains four atoms of carbon, ten atoms of hydrogen, and one of oxygen. Butylic alcohol, a very different substance, has precisely the same composition. We now know that in the former the atom of oxygen is in the middle of a chain of carbon atoms, whereas in the latter it is at one end of that chain. You might fancy it impossible to decide upon anything like consistent evidence such questions as this, but I can assure you that the atomic theory, as now used by chemists, [illegible] which [illegible] independent observers, and command general assent. That these conclusions are, as far as they go, true descriptions of natural phenomena is shown by the fact that each of them serves in its turn as a stepping-stone to further discoveries. One other extension of our knowledge of atoms I must briefly mention, one which has as yet received but little attention, yet which will, I venture to think, be found serviceable in the study of the forces which bring about chemical change. The original view of the constitution of molecules was statical; and the chemists only took cognisance of those changes of place among their atoms which result in the disappearance of the molecules employed, and the appearance of new molecules formed by their reaction on one another. I had occasion to point out a good many years ago that molecules which appeared to be chemically at rest are reacting on one another, when in suit-

able conditions, in the same kind of way as those which are manifestly in a state of chemical change. Thus a liquid mixture formed from two compounds contains molecules of four kinds, which we may describe as the two materials and the two products. The materials are reacting on one another, forming the products; and these products are, in their turn, reacting on one another, reproducing the materials. If one of the products of atomic exchange between two molecules is a solid while the other remains liquid (as when sodic chloride is mixed with silver nitrate), or if one is gaseous while the other remains liquid, so that the molecules of the one kind cannot react on those of the other kind and reproduce the materials, then the continued reaction of the materials on one another leads to their complete mutual decomposition. Such complete mutual decomposition of two salts takes place whenever they react on one another under such conditions that the products cannot react on one another and reproduce the materials; whereas partial decomposition takes place whenever the materials form a homogeneous mixture with the products. Now, if in any such homogeneous mixture more exchanges of atoms take place between the materials than between the products, the number of molecules of the products is increased, because more of them are being made than unmade, and, reciprocally, if more exchanges of atoms take place between the products than between the materials, the number of molecules of the materials is increased. The mixture remains of constant composition when there are in the unit of time as many decomposing changes as reproducing changes. Suppose that we were to determine by experiment the proportion between the number of molecules of the materials, and the number of molecules of the products, in a mixture the composition of which remains constant, and that we found, for instance, twice as many of materials as of products; what would this mean? Why, if every two couples of materials only effect in the unit of time as many exchanges as every one couple of products, every couple of materials is only exchanging half as fast as every couple of products. In fact, you perceive that a determination of the proportion in which the substances are present in such a mixture will give us a measure of the relative velocities of those particular atomic motions; and we may thus express our result. The force of chemical combination is inversely proportional to the number of atomic interchanges. Chemists are examining the combining properties of atoms, and getting clear ideas of the constitution of matter. Admitting, then, for the present, that such is the meaning of chemical work, we have to consider the important question of its use. What habits of mind does it engender? What powers does it develop? The requirements on the part of an investigator are accuracy in observing the phenomena with which he deals, accuracy of memory, and accuracy in manual operations in all experimental inquiries, many of them affording scope for very considerable skill and dexterity. These elementary qualities are well known to be requisite for success in experimental science, and to be developed by careful practice of its methods, but some higher qualities are quite as necessary as these in all but the most rudimentary manipulations, and are developed in a remarkable degree by the higher work of science. Thus it is of importance to notice that a singularly good training in the proper use of words is afforded by experimental chemistry. Accuracy of reasoning is no less effectively promoted by the work of experimental chemistry. Those who tread the path of original inquiry, and add to human knowledge by their experiments, are bound to practise this habit with the most scrupulous fidelity and care, or many and grave would be the mistakes they would make. Another habit of mind which is indispensable for success in experimental chemistry, and which is taught by the practice of its various operations, is that of truthfulness. Error comes before the investigator usually in the very garb of truth; and his utmost skill and attention are needed to decide whether or not it is entitled to retain that garb. True ideas of a natural phenomenon confirm and strengthen one another; and he who aids directly the development of one of them is sure to promote indirectly the consolidation of others. Each onward step in the search for truth has made us stronger for the work; and when we look back upon what has been done by the efforts of so many workers simply but steadily directed by truth towards further truth, we see that they have achieved, for the benefit of the human race, the conquest of a systematic body of truths which encourages men to similar efforts, while affording them the most effectual guidance. This lesson of the inherent vitality of truth, which is taught us so clearly by the history of our science, is well worthy of the consideration of those who, seeing that iniquity and falsehood so frequently triumph for a while in the struggle for existence, are inclined to take a desponding view of human affairs, and almost to despair of the ultimate predominance of truth and goodness. I believe it would be impossible at the present time to form an adequate idea of the vast consequences which will follow from the national adoption of systematic measures for allowing our knowledge of truth to develop itself freely, through the labours of those who are willing and able to devote themselves to its service, so as to strengthen more and more the belief and trust of mankind in its guidance, in small matters as well as in the highest and most important considerations. Chemistry presents peculiar advantages for educational purposes in the combination of breadth and accuracy in the training which it affords, and I am inclined to think that, in this respect, it is at present unequalled. There is reason to believe that it will play an important part in general education, and render valuable services to it in conjunction with other scientific and with literary studies. I trust that the facts which I have submitted to your consideration may suffice to show you how fallacious is that materialistic idea of physical science which represents it as leading away from the study of man's noblest faculties, and from a sympathy with his most elevated aspirations, towards mere inanimate matter. The material work of science is directed by ideas towards the attainment of further ideas. Each step in science is an addition to our ideas, or an improvement of them. A science is but a body of ideas respecting the order of nature. Each idea which forms part of physical science has been derived from observation of nature, and has been tested again and again in the most various ways by reference to nature, but this very soundness of our materials enables us to raise upon the rock of truth a loftier structure of ideas than could be erected on any other foundation by the aid of uncertain materials. The first thing wanted for the work of advancing science is a supply of well-qualified workers. The second thing is to place and keep them under the conditions most favourable to their efficient activity. The most suitable men must be found while still young to be trained to the work, for which we want a system which shall give them favourable opportunities of acquiring a clear and thorough knowledge of some few truths of nature, and shall supply to each student who has the power and the will to conduct researches, all material conditions which are requisite for the purpose. Let the most intelligent and studious children from every primary school be sent, free of expense, to the most accessible secondary school for one year; let the best of these be selected and allowed to continue for a second year: and so on, until the *élite* of them have learnt all that has to be learnt to advantage. Let the best pupils from the secondary schools be sent to a college of their own selection, and there subjected to a similar process of annual weeding: and, finally, let those who get satisfactorily to the end of a college curriculum be supplied with an allowance sufficient for their maintenance for a year, on condition of their devoting their undivided energies to research, under the inspection of competent college authorities, while allowed such aids and facilities as the college can supply with the addition of money grants for special purposes. Let all who do well during this first year be allowed similar advantages for a second and even a third year. Each young investigator thus trained must exert himself to obtain some appointment which may enable him to do the most useful and creditable of which he is capable, while combining the conditions most favourable to his improvement. Let there be in every college as many professorships and assistantships in each branch of science as are needed for the efficient conduct of the work there going on, and let every professor and assistant have such salary and such funds for apparatus, &c., as may enable him to devote all his powers to the duties of his post, under conditions favourable to the success of those duties, but let each professor receive also a proportion of the fees paid by his pupils, so that it may be his direct interest to do his work with the utmost attainable efficiency, and attract more pupils. Let every college and school be governed by an independent body of men, striving to increase its usefulness and reputation, by sympathy with the labours of the working staff, by material aid to them when needed, and by getting the very best man they can, from their own or any other college, to supply each vacancy as it arises. In addition to colleges, which are and always have been the chief institutions for the advancement of learning, establishments for the observation of special phenomena are frequently needed, and will doubtless be found desirable in aid of a general system for the advancement of science. Now, if a system fulfilling the conditions which I have thus briefly sketched out were once properly established on a sufficient scale, it ought to develop and improve itself by the very process of its working, and it behoves us, in judging of the system, to consider how such development and improvement would come about. There is an urgent need of accurate scientific knowledge for the direction of manufacturing processes, and there could not be a greater mistake than to suppose that such knowledge need not go beyond the elementary truths of science. Dr. Williamson concluded an able and eloquent address by urging upon his hearers the vital necessity for an onward movement in natural education as necessary for the advancement of science generally. Upon taking his seat he was greeted with loud applause.

MATHEMATICS AND PHYSICAL SECTION, Sept. 18th.

On the 18th of September, Professor H. Smith, F.R.S., the President, gave an address, in the course of which he said he thought that the British Association should try to improve and extend scientific education. It had already appointed a committee to aid in the improvement of geometrical teaching in this country, and had shown sound judgment in their work. Public opinion should be raised in favour of one definite text book for schools, improving upon the old method of teaching geometry, and the British Association should give the whole weight of its influence to the proposed change. A good school course of education

should include part or parts of physics, chemistry, and biology—a committee of the British Association to report on the teaching of natural science in schools. Science was not only practically useful, but was a good training for the mental faculties. It expanded the mind of the young, and made them feel something of the greatness of the sublime regularity and the impenetrable mystery of the world in which they were placed. Thus it trains the growing faculties, and aids in the education of the senses. He spoke of the aid given by the Government to museums and to zoology, and the very little aid it gave to physical science, adding that the Government should establish institutions to teach the latter. He hoped that pure mathematics would also come in for a modest share of State aid. The papers read in this section were, as usual, almost exclusively of a technical character.

GEOLOGICAL SECTION met in Horton-lane Schoolroom. Professor Phillips took the chair, and in his opening address pointed, in proof of the valuable aid of geology to industry, to its explorations of the ironstone formations of England, and the question which was now being put to it, to determine the extent of the British coalfields, and their probable duration. In the vale of York the great coal deposit, extending from Bradford to Nottingham, passes under the magnesian limestone, and might be found within attainable depths. To ascertain the fact, costly experiments must be made, which would require to be directed by geology. The effort to ascertain what was under the wealden should not be allowed to come to a premature end, as it would determine whether the older rocks found in Belgium lay beneath the wealden, and with them coal. The President proceeded to refer to the investigations into the physical revolutions through which the earth had passed. The investigations now going on in the limestone cliffs not far from the place of meeting were helping to clear up the history of mammalia in Great Britain. In Kirkdale Cave traces of human art appeared. Kent's Hole had given proofs of the presence of man from the earliest period, characterised by the remains of the great bear, and both there and in the cave near Settle, at much later periods domestic occupation was fully established. Professor Phillips then pointed out the progress yet to be made in geology, and said the share which the British Association had taken in the work was considerable, and might with advantage be increased. Papers were read in this section on the "Geology of the Bradford District." The biology section was divided into three departments. The general address was given by Dr. Allman, who referred to the question of distribution, and its connection with the doctrine of evolution. The doctrine of evolution had given a new direction to logical study, and a powerful influence to all future researches. It was the highest expression of the fundamental principle established by Mr. Darwin, and depended upon two admitted faculties of the human being—the transferring of character from the parent to the offspring, and the capacity of having those characters modified by external agencies and by a spontaneous tendency to variation. But, with all their admiration for evolution, they could not shut their eyes to the difficulties that existed for accepting it. One of the greatest of these was the unbroken continuity of inherited life which it necessarily required through a period of time, the vastness of which was such that the mind of man was thoroughly incapable of comprehending.

In the Anthropology Department of this section, Dr. Beddoe gave an address on the "Anthropology of Yorkshire."

GEOGRAPHIC SECTION.

Sir Rutherford Alcock presided over the Geographic section, which met in the Mechanics' Institute. In his opening address, the line of delineation between Afghan and Persia has been decided by the labours of the Arbitration Commission. The delimitation fixed by the British Government on the Upper Oxus by similar action is a pledge of peace with Russia. There is no nation, perhaps, which has so much reason to value geographical science and the art of map-making at so high a rate as the Russians. In their rapid advance across the steppes and mountain ranges of Northern Asia southward into the valley of the Amour, and Manchuria in the east, and to Khiva and Samarcand in the west, they have taken many courses. But in all they have had the immense advantage of not only knowing the territories they coveted, but being able to place them accurately on maps. The latest advance of Russia was fixed at Kulja, where she had established a trading centre, obviously dictated by a knowledge of the geographical features, giving her access to Eastern Turkestan, enabling her to push her trade on to China. There was an intimate connection between history and geography, and they must be studied together. The part which Russia plays in the history of Europe and Asia, and the future which may yet be reserved for that empire, are more a matter of physical geography than of politics or of policy, if we look to determining causes. What was Russia to do, frozen in between two seas, and with closed ports for more than six months in each year, but by an infallible instinct (in nations, as individuals, often exemplified) stretch out feelers towards the open waters, and more genial climates? We have heard much of Russia's destiny driving her southwards to the Bosphorous and eastward, in the same parallel, over the rich valleys of central and tropical Asia; but is it not a geographical necessity, far more than a political ambition, which has thus far driven her across the whole breadth of Asia, until she gained the Chinese ports on the Pacific, and southwards towards the mouths of the Danube, the sunny spots of the Mediterranean, and the head of the Persian Gulf? It not only was a natural tendency, but as natural as the descent of the glacier to the valleys, forging downwards by a slow, but irresistible pressure. After pointing out the vast fields which remained for exploration in the interest of commerce the president expressed the opinion that the establishment of fairs at suitable parts was the best means of developing trade in the East, as the native merchants would attend these, and be better distributors than English agents. Access to the southern route through Burmah were all difficulties overcome (and they are neither few nor slight), promises little in comparison with a more direct outlet for the Assam teas, and an interchange of goods and produce with the populations of Thibet, Turkestan, and Central Asia generally. The valley and passes of the Chitral are beset by many difficulties physical and political, but not more than a Government like India may surmount. As regards access by Sikkim there ought to be decision and prompt action.

Papers were read in this section on Khiva, Turcomans, and Persia.

ECONOMIC STATISTICS SECTION, Sept 18th.

Mr. Forster, M.P., presided. An interesting discussion arose on a paper read by Mr. Haughton on "Railway Amalgamation." In this paper Government management was objected to, and also the present system of management—first, because the work would be immense for any Government department to undertake, and because it would not pay. The existing system was considered unequal to the necessities of the age and the wants and demands of the public. As a compromise between both he proposed that all the companies should be amalgamated into four groups, three of which would run north and south from Inverness to Dover, viz., London and North-Western group, Great Northern group, Midland group, and the Great Western group, which would extend from Land's End, Liverpool and Manchester to London. That scheme, it was admitted, would meet the present wants of the day, and he advanced it for the public interest and to endeavour to provide for the welfare of the people.

Mr. Hyde Clarke, F.S.S., read a paper entitled "Influence of Large Centres of Population on Intellectual Manifestations." Town populations, while exhausting rural populations physically, he showed to have the intellectual superiority, and this to a certain extent in the ratio of greater populations. From the example of the smaller collegiate and cathedral cities, however, he maintained that the development was continuous, and dependent on the long-continued influence of higher educational culture.

Papers were also read by Mr. W. Hastings on "Postal Reform," by Mr. J. A. Binns on "Benefit Building Societies," and by Mr. James Hanson on "The Educational Statistics of Bradford." The day's proceedings in this section were of a most interesting character.

Mr. W. H. Barlow, F.R.S., presided in the Mechanical Science Section, and the papers read included one by Mr. W. E. Newton, C.E., on "Tilghman's Sand Blast Process for cutting hard substances."

The Chemical Section met under the presidency of Professor W. J. Russell.

A soirée took place in the evening in St. George's Hall.

NEW COMETS.

BORELLY'S comet (to be known as III. 1873, that discovered by Tempel on July 3 ranking as II. 1873) was discovered by him at Marseilles on the night of August 20, in the constellation Gemini, moving rapidly towards the south. It was examined shortly afterwards by MM. Wolf and Rayet. They describe it as presenting the form of a circular nebulosity about 2 in diameter, with a tolerably brilliant nucleus in the centre. The spectroscope showed a continuous spectrum extending from the yellow to the violet due in part to the reflected solar light, and two luminous bands, the one in the green, the other in the blue. The green band was intense, sharply defined towards the red but diffused towards the violet, the blue band (the brightness of which was not half that of the other) was also defined towards the red and diffused towards the violet. "The continuous spectrum," add the observers, "is much brighter than the spectra of the comets which we have previously examined, and is much narrower. Perhaps it is due to a solid nucleus."

The other comet (also announced in the *Athenæum*, and to be known as comet IV. 1873) was discovered by M. Paul Henry, at Paris, on the night of August 23, in the constellation Lynx. He described it as "round, very brilliant, almost visible to the naked eye, and with a central condensation."

Prof. Edmund Weiss, of Vienna, has calculated an orbit of Borelly's comet with the materials available up to August 21, by which it appears that it will be in perihelion about September 11, but will continue to approach nearer the earth for some time after that. According to his ephemeris, the places in the heavens in the following nights will be about these:—

	R A	N.P.D.
	h.m.	° ′
Sept 5	7 51	72·12
„ 9	8 3	79·43
„ 13	8 15	88·12
„ 17	8 28	97·28

Unfortunately, the moon interferes very much at present with the observation of comets and other faint objects. At the time of its waning, this comet will have increased very considerably in brightness, and will, probably, be extensively observed.—*Athenæum.*

Reviews.

Workshop Appliances, including Descriptions of the Gauging and Measuring Instruments, the Hand Cutting Tools, Lathes, Drilling, Planing, and other Machine Tools used by Engineers. By C. P. B. SHELLEY, Civil Engineer, Honorary Fellow of and Professor of Manufacturing Art and Machinery in King's College, London. London: Longmans, Green and Co. 1873.

THE various means now open to a student to obtain in a practical way anything like a fair knowledge of the general range of a handicraft or profession, such as that of an engineer, for instance, are, owing to the prevalence of division and sub-division, very scanty, and although there are books already published describing the different tools and appliances, together with the modes of using them, and rules for their application, yet at present he must be content with studying works like that now before us in order to gain general knowledge of his handicraft or trade, and so perchance, if opportunity were afforded him, of applying some, at least, of the rules, he might, by diligently following out such rules, gain such an amount of knowledge of the practical portion as would fit him to compete with a fair prospect of success for those scholarships to which the name of Sir Joseph Whitworth, Bart., is so nobly attached.

The work under notice forms another of that series of text-books issued by Messrs. Longman, of which we have before spoken in terms of commendation; and this one may fairly rank as one of the best of the series that have up to the present time been issued. To those who intend to compete for the Whitworth Scholarships this work will be of great value; in fact, one of its great aims is to aid those who intend to offer themselves as candidates for the honourable distinction we have referred to. Its pages will be found to contain a description of the various appliances and tools enumerated at the head of this notice, and of others which may be termed offshoots of them. For, as the author rightly observes, "The student, in making himself familiar with the appliances described, will but be following in the steps of many of our most eminent civil engineers, some of whom have made improvements in mechanism, upon which, however trivial they may appear in themselves, have depended the success of the most brilliant of their achievements."

In the introductory chapter of this work Mr. Shelley says, speaking of inventors and their inventions, "that they are indebted to their fellow labourers (by which term we anticipate he means the manufacturers), who by the introduction of appliances known as machine tools, &c., have rendered feasible the carrying out of their suggestions, and the performance of operations which before were utterly impracticable — have strong claims to a share of the credit." To this we offer no objection, for we agree with him that they are fully entitled to "a share of the credit" in rendering the invention a practical reality; but we would ask, is it not a fact which receives almost daily confirmation that a manufacturer is not content with "*a share*," but must forsooth take the *whole?* In reference to the introduction of the metric system into England the author says:—

"Those who desire the overthrow of our present system for the sake of uniformity can hardly be aware of the sacrifices they would impose upon the manufacturing industry of the United Kingdom, nor can they consider the extent of the change which, for the time being, would carry the inconvenience of a mixed system throughout the enormous area over which the English language is spoken. Moreover, the loss which would be caused by the alteration or replacement of all the present guages and measuring apparatus, and of many of the machines and tools used in our workshops, which would in itself be sufficiently considerable, would probably be a less serious matter than the overthrow of all the practical data and rules of calculation, by the use of which we have arrived at our present superiority in mechanical manufactures; so that there is little doubt that the disadvantages involved in the adoption of the metre, or any other new standard, would much more than counterbalance the advantage of having the same language of measure.

"These, and other considerations, led Sir J. Whitworth to suggest the retention of the inch which is, in fact, *the* unit of length for mechanical purposes, its subdivisions only being changed from vulgar to decimal fractions. This simple alteration provides us with the means of recording measurements of any required degree of minuteness, and, so far from provoking the opposition which the attempt to implant an entirely new system would encounter, it has already made great progress towards general adoption."

This view of the case we would recommend to those who advocate the introduction of the metric system. For our part, we would be glad to see the suggestion of Sir J. Whitworth develop itself so as to become more general, and we learn with satisfaction that there is hope for such a result. Our space does not permit our giving further quotations, so we must refer our readers to the work itself, and we doubt not that they will be amply repaid by its perusal. Although the author states his reason for not going into the description of the steam hammer and other well-known contrivances usually found in an engineering establishment of any great magnitude, yet, we would suggest that, if another edition of this work were called for, a description of the action of the steam hammer with illustrations should at least be given.

Principal Forbes and his Biographers. By JOHN TYNDALL. London: Longmans, Green, and Co. 1873.

IT is reported that it was common remark amongst those outside the pale of the early Christian Church: "See how these Christians love one another;" but the *raison d'etre* of this work might lead to the saying, "See how these scientifics hate each other." The preface of this pamphlet affords a sufficient *exposé* of its contents of it.—

Therein Prof. Tyndall says:—In the summer of 1856, in company with my friend Professor Huxley, and, indeed, at his suggestion, I visited the glaciers of the Alps, with a view to their investigation. The visit was the immediate outgrowth of my previous work on "Slaty Cleavage." On January 15, 1857, it fell to my lot to make our joint observations known to the Royal Society. The communication produced, I was informed, great discontent in Edinburgh; and various protests regarding it came from scientific men there to their London friends. This I regretted and deprecated, for, besides misinterpreting the object of the paper, I thought it evinced a desire to label the glaciers of the Alps with the name of a single investigator, to the exclusion of all others, thus contracting what ought to be a broad scientific question to a mere personal one. A glimpse of the effect produced by our communication is given at page 369 of the "Life of Principal Forbes," recently published by my friend Mr. Macmillan.

I could not, however, believe in the permanence of so unreasonable a state of mind, and on June 4, 1858, in a Friday evening discourse on the Mer de Glace I took particular pains to demonstrate that I was absolutely devoid of any hostile feeling towards Professor Forbes. I had occasion to refer to a mistake of his, and I introduced the subject, and followed it up by an expression of opinion regarding him in these words:—"Too much weight must not be attached to this explanation. It is one of those suggestions which are perpetually thrown out by men of science during the course of an investigation, and the fulfilment or nonfulfilment of which cannot materially affect the merits of the investigator. Indeed, the merits of Forbes must be judged on much broader grounds, and the more his labours are compared with those of other observers, the more prominently does his comparative intellectual magnitude come forward. I will not content myself with saying that the Book of Professor Forbes is the best book that has been written upon the subject; the qualities of mind, and the scientific culture invested in that excellent work, are such as to make it, in the estimation of the physical investigator at least, outweigh all other books upon the subject taken together. But while thus acknowledging its merits, let a free and frank comparison of its statements with facts be instituted."

To my regret, however, it soon became clear to me that this "free and frank comparison" would be tolerated on one condition alone, and that is, that its results should be mere confirmations of the views previously enunciated by Professor Forbes. No lover of freedom would willingly yield to such an attempt to fetter him. Discussion waxed warm, and considerable men, some of them by no means tender to me or to my work, mingled in the controversy. On one occasion, as I was informed at the time, an eminent philosopher went so far as to state that the only contribution I had ever made to our knowledge of the glaciers was to take Auguste Balmat to the summit of Mont Blanc, and cause him to be frost-bitten. However, matters mended afterwards, and some years subsequent to the occasion here referred to, at his own initiative, I had the pleasure of conversing most amicably about Alpine glaciers with this same philosopher. This and other severities I permitted to pass without remonstrance at the time, and not till whispered threats of further punishment became intolerable did I resolve to make myself more fully acquainted with the history of the subject, and bring these rumours to an issue in the "Glaciers of the Alps."

My original intention regarding that work, and my reasons for deviating from it, are given at the close of the introductory chapter in these words:—"When the idea of writing this book first occurred to me, it was not my intention to confine myself to the glaciers alone, but to make the work a vehicle for the familiar explanation of such general physical phenomena as had come under my notice. Nor did I intend to address it to a cultured man of science, but to a youth of average intelligence, furnished with the education which England now offers to the young. I wished, indeed, to make it a boys' class-book, which should reveal the mode of life, as well as the scientific objects, of an explorer of the Alps. The incidents of the past year have caused me to deviate in some degree from this intention."

The "incidents" here referred to are those noticed above; and they gave to certain pages of the "Glaciers of the Alps" a controversial tone which I should have been only too happy to avoid.

Accident in 1872 led to the realization of my first intention, and caused me to publish a boys' book of the glaciers. How the book originated is hereafter shown. I thought it innocent; others, I regret to say, think it the reverse; and they have expressed their thoughts in the "Life of Principal Forbes" referred to above. I am challenged to meet their criticisms, which, I find, are considered to be conclusive by some able public journals and magazines. Thus the attitude of a controversialist is once more forced upon me. Since the death of Principal Forbes no one

has heard me utter a word inconsistent with tenderness for his memory; and it is with an unwillingness amounting to repugnance that I now defend myself across his grave. His biographers profess to know what he would have done were he alive, and hold themselves to be the simple executors of his will. I cannot act entirely upon this assumption, or deal with the dead as I should with the living. Hence, though these pages may appear to some to be sufficiently full, they lack the completeness, and still more the strength, which I should have sought to confer upon them had my present position been forced upon me by Principal Forbes himself instead of by his friends.

I think it on every account deplorable that this controversy should have been revived. Two extracts will show the bitter form it assumed at the outset. The first is from the ablest of northern journals, the *Scotsman*; the second from the high-toned and intellectual New York *Nation*. In a review of the "*Life and Letters* of Principal Forbes,"* the *Scotsman* says:—

"The first manifestation of opposition came from M. Agassiz, who, immediately after the announcement by Forbes, in 1842, of his discovery of the veined structure of glaciers, wrote a paper in the same journal, claiming the discovery as his own. . . . Forbes answered M. Agassiz, in 1843, in a paper (which Professor Tait has printed in an appendix), giving a circumstantial narrative of the whole affair, backed by testimony. If ever a man stood convicted of misstatement and self-contradiction, M. Agassiz seems to us to be in that position. Yet no attempt has been made during all these thirty years to controvert or answer the charge."

The reviewer further honours me with this and other references, accompanied by various reflections and implications:—

"The most persistent opponent of Forbes's reputation has been Professor Tyndall. It is well known, however, to those behind the scenes that he has not been alone in his hostility; he only represents a certain *coterie* in the Royal Society who from their metropolitan eminence affect to look down on everything provincial."

From this imaginative picture I turn to the review in the *Nation*; it runs thus:—

"The authors of the 'Life and Letters' have given us from Forbes's own letters all that was necessary to show a course of duplicity towards the man with whom, to quote his own words, he 'served his apprenticeship in glacier observation,' unparalleled in the annals of science. If justice to the dead could not suffer such mild statements as those of Tyndall to pass unanswered, it is high time that the insults which have been heaped upon the living by Forbes himself during his lifetime, and by his friends since his death, should be noticed. Professor Agassiz, who has been the object of all this abuse, never defends himself against personal attacks; he can well afford to leave to posterity the decision of his claims; but he must pardon his friends if they come forward now and make a plain statement of the other side of the question."

The Moon: Her Motions, Aspect, Scenery and Physical Condition. By RICHARD A. PROCTOR, B.A., Cambridge, Honorary Secretary of the Royal Astronomical Society, &c., &c. With three lunar photographs by Rutherford (enlarged by Brothers), and many plates, charts, &c. London: Longmans, Green, and Co. 1873.

THIS is a work that every student of astronomy may read with pleasure and profit.

To give the reader a definitive statement of the contents of this work would be to write an epitome which would be manifestly unfair to the reader and the author, as it would be the substitution of one man's work for another's. We can, however, glance at a character of its contents, mentioning that it treats of the moon's distance, size, and mass; the moon's motions; the moon's changes of aspect—rotation, libration; study of the moon's surface; lunar celestial phenomena; condition of the moon's surface; and a comprehensive index to the map of the moon. As likely to interest the reader, we may quote the following passages. In reference to the moon's motions, Mr. Proctor, after a very readable and lucid exposition of Newton's law of gravitation and its applicability to the motions of the moon, proceeds as follows:—

"Newton had therefore only to determine whether the force continually deflecting the moon from the tangent to her path is equal in amount to the force of terrestrial gravity reduced in accordance with this law of inverse squares, in order to obtain at least a first test of the correctness of the theory which had suggested itself to his mind.

Mr. Proctor then, by the aid of diagrams, states the steps of Newton's calculation, and that it resulted in a discordance too great to admit of being reconciled in any way with the theory he had conceived. If the deflection of the moon's path had given a result greater than the actual value of gravity, he could have explained the discrepancy as due to the circumstance that the moon's own mass adds to the attraction between the earth and herself. But a less value was quite inexplicable. He therefore laid aside the investigation.

Fourteen years later Newton's attention was again attracted to the subject, by a remark in a letter addressed to him by Dr. Hooke, to the effect that a body attracted by a force varying inversely as the square of the distance, would travel in an elliptic orbit, having the centre of force in one of the *foci*. I do not at present pause to explain this remark, which is indeed only introduced here to indicate the sequence of Newton's researches. It is to be noted that Hooke gave no proof of the truth of his remark; nor was there anything in his letter to show that he had established the relation. He was not, indeed, endowed with such mathematical abilities as would have been needed (in his day) to master the problem in question. Newton, however, grappled with it at once, and before long the idea *suggested* by Hooke had been mathematically demonstrated by Newton. Yet, even in ascribing the idea to Hooke's suggestion at this epoch, we must not forget that Newton, in the very circumstance that he had discussed the moon's motion as possibly ruled by the earth's attraction, had implicitly entertained the idea now first explicitly enunciated by Hooke: for the moon does not move in a circle around the earth, but in an ellipse."

The following, on the condition of the moon's surface, will interest many of our readers:—

"It is not difficult to show reasons at least for believing that the face of the moon must be changing more rapidly than that of our earth. On the earth, indeed, we have active subterranean forces which may, perhaps, be wanting in the moon. On the earth, again, we have a sea acting constantly upon the shore,—here removing great masses, there using the *debris* to beat down other parts of the coast, and by the mere effect of accumulated land-spoils acquiring power for fresh inroads. We have, moreover, wind and rain, river action, and glacial action, and, lastly, the work of living creatures by land and by sea, while most of these causes of change may be regarded as probably, and some as certainly, wanting in the case of our satellite. Nevertheless, there are processes at work out yonder which must be as active, one cannot but believe, as any of those which affect our earth. In each lunation, the moon's surface undergoes changes of temperature which should suffice to disintegrate large portions of her surface, and with time to crumble her loftiest mountains into shapeless heaps. In the long lunar night of fourteen days, a cold far exceeding the intensest ever produced in terrestrial experiments must exist over the whole of the unilluminated hemisphere; and under the influence of this cold all the substances composing the moon's crust must shrink to their least dimensions—not all equally, (in this we find a circumstance increasing the energy of the disintegrating forces), but each according to the quality which our physicists denominate the coefficient of expansion. Then comes on the long lunar day, at first dissipating the intense cold, then gradually raising the substance of the lunar crust to a higher and higher degree of heat, until (if the inferences of our most skilful physicists, and the evidence obtained from our most powerful means of experiment can be trusted) the surface of the moon burns (one may almost say) with a heat of some 500° F. Under this tremendous heat all the substances which had shrunk to their least dimensions must expand according to their various degrees; not greatly, indeed, so far as any small quantity of matter is affected, but to an important amount when large areas of the moon's surface are considered. Remembering the effects which take place on our earth, in the mere change from the frost of winter to the moderate warmth of early spring, it is difficult to conceive that such remarkable contraction and expansion can take place in a surface presumably less coherent than the relatively moist and plastic substances comprising the terrestrial crust, without gradually effecting the demolition of the steeper lunar elevations. When we consider, further, that these processes are repeated not year by year, but month by month, and that all the circumstances attending them are calculated to render them most effective because so slow, steadfast, and uniform in their progression, it certainly does not seem wonderful that our telescopists should from time to time recognize signs of change in the moon's face. So far from rejecting these as incredible, we should consider the wonder rather to be that they are not more commonly seen, and more striking in their nature. Assuredly there is nothing which should lead our telescopists to turn from the study of the moon, as though it were hopeless to seek for signs of change on a surface so desolate. Rather they should increase the care with which they pursue their observations, holding confidently the assurance that there are signs of change to be detected, and that in all probability the recognition of such change may throw an instructive light on the moon's present condition, past history, and probable future."

A Manual of Practical Assaying. By JOHN MITCHELL, F.C.S. Fourth edition. Edited by William Crookes, F.R.S., &c. London: Longmans, Green, and Co. 1874.

THIS is a new edition of a standard work, criticism on the general character and construction of which is altogether out of place, inasmuch as it has now passed beyond the stage of trial into that of practical use and adoption; and that it has been found to give general satisfaction is fully proved by the fact that this is the fourth edition of a work, which is no mere skim-the-surface production, a few pages in compass, but a thoroughly practical work of detailed information, extending to nearly 900 pages. Mr. Mitchell's work, as some of our readers may be aware, is based on "Berthier's Traité des Essais par la Voie Sèche." The mechanical and chemical operations of assaying are treated in full, inclusive of a description of the apparatus required, their mode of use, &c., also furnaces, fuel, and

* For a critical notice of this work, see Monthly Notice for last month (September number of this journal).

crucibles, together with a description of the best pyrometers, and their applications are not forgotten, nor are the use of the blowpipe, and all the appurtenances, as fluxes, supports, &c. The action of the fluxes on some mineral substances are treated of, as also the discrimination of many minerals by means of the blowpipe, aided by a few tests by the humid method, and the humid analysis of many mineral substances, their composition, locality, &c., receive particular notice, as likewise does the complete assay of all the common metals, in addition to which the assay of sulphur, chromium, arsenic, heating power of fuel, &c., are fully discussed; and a copious table drawn up for the purpose of ascertaining in assays of gold and silver the precise amount, in ounces, pennyweights, and grains of noble metal contained in a ton of ore from the assay of a given quantity.

The work has since its first appearance been subject to the revision of Dr. Rohrig, M.E., who incorporated into it various Continental improvements, as set forth in Professor Kerl's *Probirkunst*, and in this fourth edition Mr. Crookes has carefully revised the whole work, so that it now forms a practical guide and director to the assayer quite in accord with the progress of the art of assaying, setting forth such improvements, important to the assayer as enable him to secure greater accuracy in his results, or to occupy less time in obtaining them. The general plan of the work, and the arrangement of the chapters, remain the same as in the third edition; but new matter has been added, whilst some of the chapters have been rewritten. Many processes and descriptions, which have been superseded by improved methods, have been omitted. Notwithstanding this, it has, it appears, been found necessary to add more than 100 pages to the volume. In Chapter IV., treating of the production and application of heat, much new information will be found respecting the employment of gas in the laboratory. In Chapter V. improved processes are given for the assay of coal before the blowpipe. Chapter VII., treating of the blowpipe and its use, is much altered; it contains a complete scheme for the discrimination of minerals, drawn up by Professor Thompson of Sydney, which cannot fail to be of the greatest value to mineral explorers. The other chapters, relating more especially to the different metals, contain the most recent and trustworthy processes for their determination, in addition to those in general use by assayers. After consultation with many practical men, it has, it seems, been deemed unadvisable to change the chemical equivalents and notation adopted in previous editions. Save this, the work has the aspect of an entirely new one.

A Mathematical Treatise on the Motion of Projectiles, founded chiefly on the Results of Experiments made with the Author's Chronograph. By Francis Bashforth, B.D. Asher and Co.

This is a valuable work on the subject of practical importance to all who take an interest in improving our war instruments, embodying the results of Prof. Bashforth's eight years' labours, so arranged as to be especially adapted for the instruction of the advanced class of Artillery officers, and contains the methods and tables for accurately calculating the trajectories of projectiles, the whole of the data for which has been derived from actual experiment with the clock chronograph. The mathematical investigations of Bernoulli, published a century and a half ago, has been thus rendered practically useful.

It may surprise many people to learn that no systematic series of experiments has yet been made and the Professor recommends a series of experiments to be undertaken to determine, in a satisfactory manner, the law of perforation of iron plates by elongated shot, and advocates the use of guns with small bores of half to three inches, in connection with suitable thicknesses of iron plates, believing that the law of penetration would, in this way, be more accurately, and far more cheaply determined, than by the use of the large guns now in the service.

The Sewage Question and the Lime and Cement Process of Major-General H. Y. D. Scott, C.B. With the opinions of the many eminent Chemists, Engineers, and Agriculturists who have given testimony in favour of this process. London: Printed by Nissen, Parker and Arnold, 43, Mark-lane, for Scott's Sewage Company, Limited, 26, Great George-street, Westminster. 1873.

This pamphlet, advocating the claims of General Scott's cement making and sewage utilising inventions, is just now, when a loud outcry is being made against the use of liquid sewage as a manure for growing crops, worthy of careful perusal and earnest consideration. General Scott and his friends who constitute the company for carrying out his processes, though not entering into the wholesale condemnation of sewage irrigation, fully believe that some process of defecation should be resorted to before sewage is applied as manure, and the process they propose is to precipitate the solid matters and produce cement, and leave defecated liquid which will be a safe and harmless manure. The following extract will convey a tolerably correct notion of the *rationale* of the system advocated in this pamphlet:—

Now it is manifest that we have, in the deposit produced, both in the mineral matters removed from the sewage water and in the materials added to produce precipitation, substances analogous to the components of the limestones that are employed in the manufacture of hydraulic cements and limes. After calcination, the products are perfectly similar, for all the organic matter has then been destroyed, the carbonic acid and water have been expelled, and nothing remains but lime and clay, together with some other substances, such as the alkalis, phosphates, &c., which are found in small quantities in all hydraulic limes and cements.

The discovery that hydraulic limes and cements resulted from the calcination of limestones containing clay, was first made by Smeaton, the celebrated engineer; and Vicat subsequently determined the proportion of clay which it was necessary that limestones should contain, in order to yield limes possessing in greater or less degree the property of setting in water. Vicat, indeed, established a factory at Moudon, near Paris, at which artificial limes were made by calcining mixtures of chalk (carbonate of lime) and clay in the proportions necessary to give the required results.

In this country, also, and abroad, the so-called Portland cement is made by calcining at a high temperature a mixture of 75 parts of chalk and 25 parts of clay. These ingredients are triturated in water and are then allowed to subside in tanks.

It will be readily seen that there must be a great similarity between the compound thus produced and that which results from introducing into a sewer quick-lime and clay, in the proper proportions for making cement or hydraulic lime, and then allowing precipitation (of the carbonate of lime formed, and of the clay) to take place in large settling tanks, such as are used in sewage works.

The chief points of difference, which are entirely in favour of the sewage process, are:—

1st. The more intimate mixture which can be brought about in the sewage water, owing to the impalpable nature of the precipitate of carbonate of lime which separates on the addition of the lime.

2nd. The more rapid settlement of the sewage precipitate than of the mixture of chalk and clay, owing to the presence of flocculent matter, which entangles the fine particles.

3rd. The presence of organic matters which are carried down from the sewage with the precipitate, and which will serve for fuel to burn the mixture to lime or cement.

The amount of fuel, indeed, which the sludge will afford is so large, as we have already seen, that, in the absence of any better mode of getting rid of the deposit, and in consequence of the loss which results from attempting to deal with it as a manure, it has even been proposed to get rid of it by burning, without reference to any product which may contribute towards meeting the expense of the treatment.

The idea will occur to many—it is an objection to the process which is constantly raised—that the amount of cement produced would be more than the country can use.

This, however, is said to be an error. The quantity of inferior lime which is used in the greater part of the towns of England, and in the country around them, far exceeds the quantity of cement that could be produced in this manner.

It is to be borne in mind that the ultimate effect of the process would be simply to divert the inferior limes from the direct channel for a time, and, after using them for cleansing the sewage, to return them again to the building trade in a greatly improved form. The increase in the absolute quantity of mortar-making material will be such only as will be due to the cement making elements which are gained from the sewage, and from the clay which may be added, and these, taken together, would rarely exceed the quantity of cement now used in manufacturing towns.

The process will, in fact, yield only from half-a-ton to three fifths of a ton of cement per week, for every 1,000 inhabitants.

The question of replacing such pure, and therefore inferior, limes as would be used for the precipitation process, by good hydraulic limes and cements, will be better appreciated by engineers and architects than by the general public. Nevertheless, there are few householders who do not find reason to complain of the softness of the plastering on the walls, and the amount of money expended in re-pointing brickwork is not unimportant.

Scientific Handicraft. A Descriptive Illustrated and Priced Catalogue of Apparatus suitable for the performance of Elementary Physics. By John Joseph Griffin, F.C.S. Vol. I. Mechanics, Hydrostatics, Hydrodynamics, and Pneumatics. London: John J. Griffin and Sons, 22, Garrick-street, W.C. 1873.

The contents of this very useful work is plainly indicated by its title as above stated. This plan of combining a trade catalogue of scientific instruments, with examples and experiments, partakes of a somewhat novel character, and doubtless the work will be well appreciated by those for whom it is specially intended. We consider it will more particularly be found serviceable to science teachers, to whom we commend its perusal. The way in which the various matters treated of are handled in this first volume gives us confidence that the other intended volumes will be found equally useful to all interested therein, and we trust the success of the present issue will be such as to enable the author to carry out his intentions as regards the other branches of practical science. However, the nature of the subjects dealt with in its pages render it useless for us to make any quotations from the work, for they would be difficult to understand without the aid of the illustrative engravings referred to.

[Continuation of Reviews will be found on Page 163.]

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NOTICES.

TO MEMBERS OF COUNCIL.

A meeting of the Council will take place on October 16th, at 7 o'clock.

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All Subscriptions should be paid to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W.

Proceedings of the Institute.

A meeting of the Council (ordinary and special) of the Inventors' Institute was held on the 4th of September, 1873, at the Office of the SCIENTIFIC AND LITERARY REVIEW, 21, Cockspur-street. Mr. A. J. Murray, Member of Council, presiding.

After the minutes of the last meeting had been read and confirmed as being correctly entered,

The Secretary informed the meeting that, as this was the first special Council meeting having a sufficient quorum of members which had met for some time past, it was competent, according to the rules, for that meeting to reconsider any resolutions passed at any ordinary Council meetings held in the interval that had occurred since the last duly constituted special Council meeting.

At the request of the Chairman, the Secretary recapitulated the business transacted at the ordinary Council meetings referred to, and the Chairman then asked if anyone had any motion to make thereon. Whereupon, no motion being made, he proceeded to take the next business, which was as to the arrangements which should be made in regard to the Institute being represented at the British Association meeting at Bradford.

Mr. Carttar moved that Mr. F. H. Varley and Mr. A. J. Murray be, and are hereby, specially requested to attend the Bradford meeting as hon. commissioners.

This was seconded by Mr McLauchlan, and carried unanimously.

The Secretary was asked if he could go to Bradford, but stated that he feared he should be unable to do so.

Mr. Morgan then moved, "That the several members of the Institute residing, or being on business, at Bradford, especially S. C. Lister, Esq., be requested to attend the British Association, and act as representatives of the Institute."

This was seconded by Mr. McLauchlan, and carried unanimously.

The usual financial communications from the Treasury Committee were made to the Council, and the following gentlemen admitted as,—were ordered to be placed on the list of,—members, viz., Messrs. Louis Bourget, George Percival Spooner, Peter Thomason, Edward Newbold, John T. Sprague.

Monthly Notices.

At a recent general assembly of French papermakers, MM. Jourdenil, Parizot, and Grease, the well-known firm of paper manufacturers, submitted some samples of the sheath of the hop stalk as a material for papermaking. By removing the outer skin and subjecting it to a certain chemical process, a textile substance, possessing the qualities which make rags so valuable in papermaking, namely, length, suppleness, and delicacy of texture, has been produced. The invention has been patented, and seems likely greatly to interest English hop-growers.

It is with much pleasure we announce that her Majesty has conferred the honour of Knighthood on the eminent Civil Engineer, John (now Sir John) Hawkshaw. This honour is a well-earned mark of recognition of the man, and a well-merited compliment to the Civil Engineering profession. It is a pity, however, that the Government could not see its way clear to making a batch of knights from amongst the great Civil Engineers of the day, and that instead of ordinary knighthood an order of merit should be instituted (say an expansion of the Order of the Bath), so that men who have won this position for themselves by worth and talent shall not be confounded with turtle-loving Aldermen, who have been lucky enough to play the lacquey to some semi-barbaric potentate or scion of royalty out for a holiday.

On the volatilization of metallic iron, the *Journal* of the Iron and Steel Institute reports that Dr. Elsner, of the Royal Porcelain Manufactory at Dresden, placed a piece of wrought iron in a closed crucible of unglazed porcelain, and exposed it for several hours to a temperature of fully 3,000 deg. in a kiln. On examining the crucible when cold, it was found that the iron had been volatilized and condensed on the under surface of the crucible-lid in small needle-shaped crystals.

The *Phylloxera*, so injurious to vines, it is stated by M. Faucon, may be destroyed by prolonged submersion of the vines under water. He, therefore, suggests that the vineyards should be flooded in the autumn or in the winter: official experiments on this subject are to be carried out during the coming season.

A bone cavern, presenting traces of human occupation, has it is stated, been discovered in Silurian rocks on the coast southwest of the Bay of Kirkcudbright. The stalagmitic breccia and the cave-earth have yielded numerous bones of animals,—including those of the ox, red-deer, goat, horse, pig, and several rodents,—together with fragments of bronze and objects in bone, evidently of human workmanship. The exploration of this seemingly interesting cave is in the hands of Mr. A. J. Corrie and Mr. W. Bruce-Clarke.

M. Nordenskiold, writing from Mossel Bay (lat. 79 deg. 54 min. N.), states that the vegetation of Algæ attains a maximum in the darkness and cold of an arctic winter. A highly sensitive photographic plate kept for twelve hours at the bottom of the sea, where Algæ flourished, was raised unchanged, the temperature being 2 deg. Cent. In the same letter he states, that Dr. Wykander and Lieutenant Parent had studied the aurora with much care by the aid of the spectroscope. The indications appeared to favour the idea that the phenomena were related to the fall of fine particles of iron and carbon, the presence of hydrogen, and probably of snow. The *Comte Rendus* for the 21st of July, in which this letter is printed, gives a communication from Father Secchi, "*On the Spectra of Iron and other Metals.*" He is led, from his researches, to doubt if the line seen in the corona of eclipses, which has been considered to indicate iron, does really do so. He concludes that, if it belongs to iron, it is developed under unknown conditions of temperature.

Under the name of *Drepanornis Albertisi*, Dr Sclater, of the Zoological Society, has lately described a new Bird of Paradise, which was discovered a short time ago by Signor Luigi Maria D'Albertis, at Atam, in the Arfak Mountains of New Guinea.

One of the most curious questions of botanical geography is that of the transport of seeds across seas by means of currents, winds, ice, and other agents. At the instance of the eminent botanist, M. A. De Candolle, some experiments on this subject have been made by M. Thuret, who lives at Antibes, on the French shore of the Mediterranean. The results of these experiments, which were made to determine the relative durability of different kinds of seeds when kept in sea-water, are published in the *Bibliothèque Universelle et Revue Suisse*, and are interesting for comparison with the kindred experiments of Darwin and Charles Martins.

The supply of lithographic stone from Germany has been gradually falling off—hence it is important to notice the discovery of two sources of supply in Italy, one near the French frontier and the other on the coast of the Gulf of Genoa. It is said that the stones are of superior quality.

The *Bulletin de la Société Chimique de Paris*, amongst many chemical papers of much interest, draws some attention to a waterproof glue, which promises to be of considerable value. The action of light in rendering the size on paper, when it is coated with the bichromate of potassa, insoluble was first noticed by Mr. Mongo Ponton, and the principle has been applied to several of the photographic printing processes. Gum, glue or gelatine may thus be rendered insoluble, and the action takes place, though slowly, in the dark. A concentrated solution of the bichromate of potassa is kept in the dark, and some of it is added to boiled gelatine. Anything glued with this may, after a little time, be washed with hot water without effect. A parchment paper, used largely for wrapping the pea-sausages of the German soldier, is prepared by M. J. Stinde with this chromatized gelatine.

The French Photographic Society informs us in its Bulletin that M. Despaquis has prepared some very pleasing photographs with the Bitumen of Judea which was, it will be remembered, the material used by M. Nicephore Niepce, more than half a century since, before his connection with Daguerre.

In Dr. Quesneville's *Moniteur Scientifique* for August, is a report presented to the Industrial Society of Mulhouse, by M. Fr. Goppelsrœder, "On the Regeneration and Restoration of Oil Paintings by Pettenkofer's Method." This report, which examines into the physical and chemical changes which take place in paintings, and gives experiments on the means employed by Pettenkofer for the revival of colour and the like, is worthy of every attention.

The Commissioners "to make inquiry with regard to scientific instruction and the advancement of science" have issued their third report. It recommends no radical changes such as are really needed, and concludes with this statement:—"We have endeavoured to indicate what, in our judgment, should be the general direction of such changes, and we have not altogether abstained from offering suggestions as to particular modifications or improvements of existing arrangements; but we are sensible that questions of detail are likely to be best discussed in the Universities themselves, where they will come under the consideration of persons who have made the theory and practice of education the business of their lives, and whose judgment on all points connected with the working of their own system ought to carry great weight."

On the 21st of August the French Association for the Advancement of Science commenced its meeting at Lyons under the presidency of M. de Quatrefages, who chose for the subject of his inaugural address, "Le Siecle de la Science, l'Enseignement Scientifique." Dr. Carl Vogt was present, and that eminent *savant*, whose protest against the annexation of Alsace and Lorraine has endeared him to the French, was warmly received. The sittings terminated on the 28th, and on Friday several members of the association paid a visit to Geneva, where they met with a cordial reception.

Asphalte paper, or more correctly, paper coated with asphalte, is again claiming some attention. It is strongly recommended for lining boxes and cases, which are to receive goods requiring protection from the damp. It is also "rolled up into pipes for conveying water." In 1862 water-pipes thus manufactured were exhibited, and from their lightness and supposed durability, some experiments were made with them, especially in mines, where the water speedily corrodes the iron. At Polberro Tin Mine, in Cornwall, they were introduced; but were soon abandoned, as they failed entirely to resist the pressure of the water in the pumps.

The third annual report of the deputy-master of the Mint has been recently issued. It gives some good examples of the value of the applications of science to the processes of coining. The value of the spectroscope to quantitative analysis, especially in the gold-parting assay, is proved by Mr. Roberts to be great. Traces of gold have been found in the worn-out silver coinage; 81 27 oz. of gold have been recovered from 117,048 oz. of old crowns and half-crowns.

The report of the Meteorological Committee of the Royal Society for the year 1872 is before us. It is not possible to discuss the question of the value of the system of meteorological observations as carried out under the direction of this Committee. But while we most fully admit the importance of the land meteorology of the British isles, and the real advantages of weather telegraphy and signals, we doubt whether the information received by the committee on ocean meteorology—notwithstanding their statement that it "comprises the investigation of the meteorological conditions of the entire ocean,"—is worth the £2,000 it costs, seeing that observations were made in ninety-three ships only, and that the statement of the localities whence observations were derived shows that very vast tracts of the ocean were unobserved.

Potasso gypsite, a beautifully crystallized double sulphate of calcium and potassium, discovered some years since by Mr. J. A. Phillips, as an incrustation on a boiler employed for the evaporation of sulphate of potassium, has been recently found as a mineral, associated with rock-salt, at Kalusz. Dr. F. Ulrich, who has examined both the natural and the artificial crystals, finds, however, that they belong to the monoclinic and not to the rhombohedral system, as announced by Prof. W. H. Miller; this error is explained by the fact that the crystals of potasso-gypsite are twins.

Prof. Morton has communicated to the *Chemical News* an important "Investigation of the Fluorescent and Absorption Spectra of the Uranium Salts," by himself and Dr. H. Carrington, Bolton.

During an unusually heavy snow storm in Stockholm, which continued for five or six days, in December, 1871, Nordenskjold detected, even in those portions of the snow which fell latest, a black carbonaceous powder, charged with very small spangles of metallic iron. He has since found similar substances in the snows of the Arctic Regions and from the heart of Finland. It will be curious to learn from the analysis, which he has recently promised, whether the iron in this cosmical dust is similar to meteoric iron.

L'Abbé Moigno, in *Les Mondes* for September 4, publishes some curious remarks on "La Vision et les Animaux Mystérieux d'Ezéchiel," by M. l'Abbé Darras, who has recently published his "Histoire Générale de l'Eglise, depuis la Création jusqu'à nos Jours."

Kjerulfine is the name of a new mineral species, described by Von Kobell. It is a phosphate of magnesia and fluoride of calcium, occurring at Bamle, in Norway, and is named in compliment to the Norwegian geologist, Kjerulf.

In the *Annals and Magazine of Natural History*, for August, Dr. H. A. Nicholson describes several new species of Stromatopora, from the Silurian and Devonian formations of Western Canada. Stromatopora is so singular a genus that its affinities are very obscure. Some of the new species, however, exhibit certain points of relationship to the Spongidæ, which have not hitherto been recorded, and tend to strengthen the view which refers Stromatopora to the family of Sponges.

The recent wet weather has seriously interfered with harvest operations in the late districts of the West of England and Wales. In a precarious climate like ours it is not surprising that the farmer grumbles so much. He would be happy if his calling allowed him to be as heedless of barometrical and thermometrical changes as most other people. Any discovery that would make him less dependent on cold and rain, wind and drought, would be a great boon. How to harvest crops in wet weather is a question the solution of which has long gained the attention of practical men, and five years ago the Society of Arts awarded a prize of 50 guineas and a gold medal for the best essay on the subject. The successful writer was Mr. W. A. Gibbs, Gillwell Park, Essex. His system is to dry sheaves of corn by drawing a hot blast of air through them at 320 deg. Fahrenheit, by means of a fan with a speed of 600 revolutions per minute. By this means a small three-horse power steam-engine can be made to thoroughly dry thirty-two sheaves of wet corn in fifteen minutes, at a cost of about 1s. per quarter of threshed corn. The device, to which the *Chamber of Agriculture Journal* has drawn renewed attention, is well worth the attention of farmers.

New Planets.—The three small planets discovered in France last year have received the names Liberatrix (in honour of M. Thiers), Vellida, and Johanna. The five planets which still remain without names were all discovered by Prof. Watson, of Ann Arbor, Michigan, U.S., three last year and two this.

Freshwater Fish.—A collection of freshwater fishes, made at Shanghai by H.M. Consul, Mr. R. Swinhoe, has been reported on by Dr. A. Günther, of the British Museum. The collection is notable for containing an unusually large proportion of new species, or such as have hitherto been but imperfectly known.

Tribunals of Commerce.—A meeting was called by Mr. Lyne, at the London Tavern, on this subject, on the 18th inst. It was not, as Mr. J. R. Taylor, the Hon. Secretary, informs us, a meeting of the Tribunals of Commerce Association, of which Mr. F. W. Campin is a Member. Mr. Lyne, it is said, signified his intention to relinquish office.

General Literature.

The Sea and its Living Wonders. A Popular Account of the Marvels of the Deep, and of the Progress of Maritime Discovery, from the Earliest Ages to the Present Time. By Dr. G. Hartwig, author of "The Tropical World," &c. Fourth edition, enlarged and improved, with numerous wood cuts and chromoxylographic plates. London: Longmans, Green, and Co. 1873.

This is a new edition of a truly pleasant and withal highly scientific work, so thoroughly scientific indeed, that although we have placed it under the head of "General Literature," we have done so not because it would not more appropriately have been placed amongst the scientific works, but simply in order that our readers may at once know that amusement is to be obtained from its pages in even a higher degree, if possible, than scientific instruction, though this they will find to be of a very high order, for *dulce et utile* is the true character of the book, as every reader will readily admit.

In this fourth edition the same general character is preserved as that of other editions. "The Physical Geography of the Sea," "The Inhabitants of the Sea," and "The Progress of Maritime Discovery" being the three parts constituting the work, but two new chapters—one on "Marine Constructions," the other on "Marine Caves"—have been added; those on the "Molluscs and Cœlenterata (Jelly-fishes, Polyps)" almost entirely re-written; and those on "Fishes," "Crustaceans," "Microscopic Animals," "The Geographical Distribution of Marine Life," and "The Phosphorescence of the Sea," considerably enlarged; not to mention a number of minor improvements dispersed throughout the volume.

Great attention has also been paid to the illustrations, many of very small value having been omitted in the present edition, to make room for a number of others, which will be found of great use for the better understanding of the text.

Indeed, we may fairly affirm the statement Dr. Hartwig makes in his preface when he says he has done his best to raise the work to the standard of the actual state of science, and to render it a complete epitome of all that the general reader cares to know about the marvels of the deep.

How well Dr. Hartwig has succeeded, the reader may judge from the following extracts:—

The first of these is from the new chapter on Marine Constructions, and shows that to the man of practical science and the inventor, the aphorism applied to the poet, *Nascitur non fit*, may often be with truth appropriated. In briefly recounting the history of Eddystone Lighthouse, Dr. Hartwig says, "Strange to say, the task of rebuilding the Eddystone Lighthouse—to supply the place of that erected in 1696, by Winstanley, which was destroyed in the dreadful hurricane storm in November, 1703—once more devolved, not upon a professed architect—Winstanley being a country gentleman—but upon a Mr. Rudyerd, a linendraper of Ludgate-hill, the son of a Cornishman, who had raised himself by his talents and industry from a very low social position to a station of honourable competence. The choice, however, was not ill-made, for with the assistance of two competent shipwrights, the London tradesman constructed an edifice which, though mainly of timber, was so firmly bolted to the rock with iron branches, that for nearly half a century it resisted the fury of the billows, and might have withstood them for many a year to come, had it not been rapidly and completely destroyed by fire. This catastrophe, which happened on December 2nd, 1755, was marked by a strange accident, for whilst one of the light-keepers was engaged in throwing up water four yards higher than himself, a quantity of lead, dissolved by the heat of the flames, suddenly rushed like a torrent from the roof, and falling upon his head, face and shoulders, burnt him in a dreadful manner. Having been conveyed to the hospital at Plymouth, he invariably told the surgeon who attended him that he had swallowed part of the lead while looking upwards; the reality of the assertion seemed quite incredible, for who could suppose it possible that any human being should exist after receiving melted lead into the stomach? much less that he should afterwards be able to bear the hardships and inconvenience from the length of time he was in getting on shore before any remedies could be applied. On the twelfth day, however, the man died, and having been opened, a solid piece of lead, which weighed about seven ounces, was found in his stomach. The structure thus destroyed was, as all the world knows, succeeded by that now standing, erected under the direction of Smeaton, the justly celebrated engineer."

The following, which has reference to that remarkable marine animal, the *Octopus*, and his analogues, taken from the chapter on Molluscs, may interest many of our readers:—

All the Cephalopods—one of the orders of Molluscs (says Dr. Hartwig), are marine animals, and breathe through branchiæ or gills. These are concealed under the mantle in a cave or hollow, which alternately expands and contracts, and communicates by two openings with the outer world. The one in form of a slit serves to receive the water; the other, which is tubular, is used for its expulsion.

According to the different number of their gills the octopods are divided into two groups. The first to which the poulp and cuttle fish belong, and which comprises by far the majority of living species, has only two sets of gills, while the second, which, in the present epoch, is only represented by a few species of nautilus, has four, two on each side, according to the number of arms or feet—for these remarkable organs serve equally well for prehension or locomotion. The first group is again sub-divided into two orders, octopods and decapods, the former having only eight sessile feet, while the latter possess an additional pair of elongated tentacles, which serve to seize a prey which may be beyond the reach of the ordinary feet, and also to act as anchors to moor them in safety during the agitations of a stormy sea."

It appears that the cephalopods are extremely voracious, and would soon produce a fish famine by killing the young fish and naked molluscs, such as the oyster, but that they are themselves *chawed up*, as the Yankees have it, by the sperm whale, the albatross, and petrels, who love to skim them from the surface of the ocean, and man catches many millions to serve as bait for valuable fish cod, for instance.

At Teneriffe, in the Brazils, in Peru and Chili, in India and China, various species of cephalopods are used as food. Along the eastern shores of the Mediterranean, the common sepia constitutes now, as in ancient times, a valuable part of the food of the poor. "One of the most striking spectacles," says Edward Forbes, "is to see at night on the shores of the Ægean the numerous torches glancing along the shores, and reflected by the still and clear sea, borne by poor fishermen paddling as silently as possible over the rocky shallows in search of the cuttle fish, which, when seen lying beneath the water in search for his prey, they dexterously spear ere the creature has time to dart with the rapidity of an arrow from the weapon about to transfix its soft but firm body."

The eggs of the littoral cephalopods appear in the form of dark-coloured spindle-shaped bodies of the size and colour of grapes, and hang together in clusters, and are termed by the fishermen sea-grapes.

The Paradise of Birds. An old Extravaganza in a Modern Dress. By William John Courthope, Author of "Ludibria Lunæ." Second Edition. William Blackwood and Sons, Edinburgh and London. 1873.

This is a little poem suited for those who enjoy having a fling at the philosophic priggisms and scepticisms of the age they live in. The author is playing the mentor in holiday garb, and those who are holiday-making will find that a dip into this booklet will be no pleasure-spoiling affair, but will serve to give zest to recreation.

It would be difficult to afford any connected idea of the character and contents of this work (other than that it is *à la* Aristophanes) in any briefer way than the author himself does by the work itself. Perhaps, however, the enumeration of the *dramatis personæ* may throw some light on the matter. These are

Maresnest, a Philosopher of the "Development" Persuasion.
Windbag, a Poet of the Romantic School.
Birdcatcher, Cook, Lady, — Souls in Purgatory.
Roc, an extinct Bird in his Egg-Shell, the Gate of Limbo.
Bird of Paradise, King of the Birds' Paradise.
Jackdaw, Rook, Pigeon, Lark, Nightingale, Goldfinch, Blackbird, Thrush, Linnet, Swallow, Goose, — Birds in Paradise.
Chorus of Human Beings in Purgatory.
Chorus of Extinct Birds in the Shell.
Chorus of Birds in Paradise.
A Jury of Twelve Birds.

The prologue, spoken by Nightingale, will also aid in explaining the nature and contents of the work:—

Kind gentlemen, and ladies dear,
To a poor nightingale give ear
The poet bids me fly to you,
His audience fit (since doubtless few),
And introduce my bill of fare
For the entertainment we prepare.
If then you choose to taste the same,
And *feel* disgust—we're free from blame.
And first I say that, by your grace,
We mean to represent a place
To human sailors (save alone
To Fancy and her crew) unknown;
Not yet subjected to the reign
Of Science, tyrant and profane,—
The would-be queen, and upstart thief,
Who steals the lands of old Belief—
But unexplored (thank Heaven!) and free
To Wonder and to Poetry.

Strange things in this strange place you'll view;
Conclude not therefore they're untrue.
Fancy of all things takes precedence
In travel,—so she should in credence;
For once 'twas fashion to traduce,
But now you all believe in, Bruce.
Besides, in this our moral age,
Bards have so serious grown and sage,
(Not to say dull), and all, forsooth,
Are so well paid for preaching Truth,
You might as soon suspect pretension
In priests, as poets of Invention.

Know, too, beforehand, that we birds
Shall speak with man in human words.
If such a prodigy displease,
Quarrel with Aristophanes.
Despise the light good-natured age
That clapped "the Birds" upon the stage;
And yet what pleased the Attic state,
England, methinks, might tolerate.

Critics, fastidious and select,
Hear what from me you must expect.
If you my friend and poet praise,
You shall be happy all your days.
I will come flying in the moon,
And sing to you each night in June;
Restore the freshness to your brain,
When you have many authors slain,
And bring of epigrams a store,
That you may slay as many more.

But if this play you shall abuse,
Expect from all the feathered crows
Dire retribution. I will rouse
Vast twitt'ring armies in the boughs;
(Nor deem your persons will to us
Be sacred, since anonymous)
Then, if your Sunday clothes you wear,
And walk abroad to take the air,
To preach or visit, dine or wed,—
Keep an umbrella overhead.

The following is a pleasing fling at the philosophers:—

MARESNEST.

The rise of Species: can it be
You know not how it was? Then hear from me.
Ho! ye obsolete wings in the outset of things,
Which the clergy Creation miscall,
There was nought to perplex by shape, species, or sex;
Indeed, there was nothing at all,
But a motion most comic of dust-motes atomic,
A chaos of decimal fractions,
Of which each under Fate was impelled to his mate
By Love or the law of Attractions.
So jarred the old world, in blind particles hurled,
And Love was the first to attune it,
Yet not by prevision, but simple collision—
And this was the cause of the Unit.
That such was the feat, which evolved light and heat,
A thousand analogies hint,
For instance, the spark from the hoof in the dark,
Or the striking of tinder and flint
Of the worlds thus begun the first was the Sun,
Who, wishing to round off his girth,
Began to perspire with great circles of fire—
And this was the cause of the Earth.
Soon desiring to pair, Fire, Water, Earth, Air,
To monogamous custom unused,
All joined by collusion in fortunate fusion,
And so the Sponge-puzzle produced.
Now the Sponge had of yore many attributes more
Than the power to imbibe or expunge,
And his leisure beguiled with the hope of a child.

CHORUS

O philoprogenitive Sponge!

MARESNEST.

Then Him let us call the first Parent of all,
Though the clergy desire to hoodwink us,
For He gave to the Earth the first animal birth,
And conceived the Ornithorhyncus

CHORUS.

Conceived the Ornithorhyncus!

MARESNEST.

Yes: who, as you have heard, has a bill like a bird,
But hair and four legs like a beast,
And possessed in his kind a more provident mind
Than you'd e'er have presumed from the priest.
For he saw in the distance the strife for existence,
That must his grandchildren betide,
And resolved, as he could, for their ultimate good,
A remedy sure to provide
With that, to prepare each descendant and heir
For a different diet and clime,
He laid, as a test, four eggs in his nest—
But he only laid two at a time.
On the first he sat still, and kept using his bill,
That the head in his chicks might prevail.
Ere he hatched the next young, head downwards he slung
From the branches, to lengthen his tail.
Conceive how he watched till his chickens were hatched,
With what joy he observed that each brood
Were unlike at the start, had their dwellings apart,
And distinct adaptations for food.
Thereafter each section by Nature's selection
Proceeded to husband and wive,
And the truth can't be blinked that the weak grew extinct,
While the lusty continued to thrive.
Eggs were laid as before, but each time more and more
Varieties struggled and bred,
Till one end of the scale dropped its ancestor's tail,
And the other got rid of his head.
From the bill, in brief words, were developed the birds,
Unless our tame pigeons and ducks lie.
From the tail and hind legs, in the second-laid eggs,
The Apes and—Professor Huxley.

CHORUS.

The Apes, and Professor Huxley!

MARESNEST.

Yes; one Protoplasm, connecting the chasm
'Twixt Mammal, and Reptile, and Roc,
With millions of dozens of fungus first cousins,
Reduces the world to one stock;
And though man has a place from the Sponge at the base
In variety farthest removed,
And has managed to reach what he calls soul and speech,
Yet his blood is by language approved.
For instance, the tribe that contrives to imbibe,
While the friends, who believe in them, plunge
Their hands with mad pranks into Railways and Banks,
We term the variety Sponge.
And perhaps like our Sire, as all classes mount higher,
We shall merge into Oneness again,
Our species absorb all the rest in its orb,
And Birds, Beasts, and Fishes be Men.

REVIEWS of the following works are unavoidably postponed till next number:—

"Quantitative Chemical Analysis." By T. E. Thorpe, Ph.D., F.R.S.E. Messrs. Longmans.

"Sewage Utilization." By U. R. Burke, M.A. Messrs. E. and F. N. Spon.

"Natural History for Beginners." By H. Alleyne Nicholson, M.D., D.Sc., M.A., Ph.D., &c., &c. William Blackwood and Sons.

"A Scamper Across Europe." By T. L. Nichols, M.D. Messrs. Longmans, Green, and Co.

"Count Rumford: How he Banished Beggary from Bavaria." By T. L. Nichols, M.D. Messrs. Longmans, Green, and Co.

"Rays of Light." By F. Ayckbourn.

"Story of the Earth and Man." Hodder and Stoughton.

"The Story of a Life." By W. A. Gibbs, Esq. In the quotation given at page 143, at line eleven, for the word "as," read "at," the one word being substituted for the other by *our* typographical error.

THE WRITING-BALL, OR ELECTRIC TYPE-WRITING APPARATUS. Invented by Rev. R. Malling Hansen, Head-master of the Royal Institute for Deaf and Dumb, at Copenhagen. This is a highly scientific and most ingenious instrument, and we intend to lay full details before our readers; want of space preventing our doing this in our present number. In the meantime, those who seek to know more on this subject, can apply to Messrs. Holton and Co., 82, Gracechurch-street, London, E.C.

PATENT LAW MEETINGS AT BRADFORD. Want of space compels us to defer the report on this subject till our next. We may mention that the representative of the Inventors' Institute, S. C. Lister, Esq., a well-known manufacturer of Bradford, was voted to the chair. We may also mention, that on the subject of compulsory licenses, there seemed to be some difficulty in arriving at a conclusion.

THE LOST CANON OF BEROSUS.—Mr. George Smith has just discovered the fragments of an ancient Assyrian canon, from the Babylonian copy of which the much-contested canon of Berosus was unquestionably derived. The importance of this relic to chronologists can scarcely be over-estimated, and it will form the substance of a paper shortly to be read before the Society of Biblical Archæology by its fortunate discoverer.

HEAT IN GAS.—Amongst the many important industrial papers recently brought before the Iron and Steel Institute, there was one of great scientific interest, to which we desire to call attention. It was "The Rationale of the Combustion of Gases considered in relation to an increased supply of Heat," by M. Charles Boutmy, of the Ecole de Liége. This communication has a most important bearing on the utilisation of the gases of blast-furnaces.

DEATH OF AN OLD INVENTOR.

BY the decease of Henry Richardson Fanshawe there has just passed away from amongst us, at the age of 62 (our inventor's age), a practical worker to whom some comparatively new and important branches of industry owe not a little of their successful development. He was the son of a silk manufacturer in Spitalfields, and he and his brother, John Americus Fanshawe, early in life devoted their attention to the manufacture of vulcanized India-rubber. The history of Silvertown is, to a certain extent, their history, for they, for some years, applied their energies to the carrying out of the important rubber works there. On leaving that place John Americus became identified with the well-known firm of George Warne and Co., of Tottenham, where, in connection with his partners, he produced some most valuable improvements in rubber manufacture, while Henry R. Fanshawe took a wider field. John's steady adherence to the one subject provided him with comfortable competency, while Henry's inventive powers were so fertile that his time was occupied in inventing, and little could be devoted to their commercial development. The consequence was that although he assisted materially in building up the fortunes of others, he himself remained poor through the greater part of his career. Amongst other inventions he brought out an expeditious mode of tanning by the aid of improved machinery and process, some most important improvements in the manufacture of kamptulicon, and an exceedingly ingenious diaphragm for casks, by means of which the freshness of the liquor contained is retained to the last drop. He also devised a well-considered plan of lighting mines with gas, the gas being, as it were, isolated from the mines, and supplied with air from without by means of tubes, a second set of tubes carrying away the hot air to the surface. Amongst other things was a plan for catching fish by means of a submerged light. This, at the time, attracted much attention. A paper was read on this subject by the Society of Arts by Mr. F. W. Campin, the patent barrister, and the invention was carried out practically off Great Grimsby in the *Mary Hewitt* fishing smack. The "takes" proved its success, and after the first demonstration the old hands in the other smacks fished in a circle round the light-ship. The diffusion of light was attended by a corresponding diffusion of luck. The larger, finer fish came boldly up towards the lamp, and eagerly took the bait. Thus the *Mary Hewitt* got the bigger fish, but all the smacks got unprecedented "takes." Notwithstanding this success, sufficient capital was not found to carry out the plan on a large scale, and Henry Fanshawe sustained a severe disappointment. More recently Mr. Fanshawe brought out a most important invention for waterproofing, indurating, and otherwise improving the condition of leather. At the outbreak of the Franco-Prussian war, large contracts were secured for the supply of boots to both armies, and poor Fanshawe's star seemed to be in the ascendent. With the close of the war, however, the orders ceased, the boot and shoe manufacturers finding that there was, for profit, "nothing like leather" that had not been proofed, as the increase of durability led to a decrease in sales. This invention has been most successfully applied for boot soles and uppers, mill bands, and hose piping. The inferior portions of the hide are made equal to the best, and will fetch the same price, while low-classed butts (such as hemlock and *mimosa tannages*) will, when treated by this process, bear favourable comparison with the best English. Notwithstanding its merits, this invention has, from the want of sufficient capital to bring it prominently forward, been, from the commercial point of view, but partially successful, and poor Fanshawe has

passed away at no great remove from absolute poverty, leaving behind him a family of five daughters, for whom he was unable to make any provision. Mr. H. R. Fanshawe was in person, whilst in health, the ideal of an Englishman, above the middle height, with large, well-set frame, of open, pleasing countenance, and with kindly-looking blue eyes. He had few, if any, enemies, but from his retiring, unassuming manner, his many friends were unable to render him that assistance which they would gladly have done. Mr. Fanshawe's remains were interred at Bow Cemetry, on the 22nd July. He has left behind him, in the hands of a friend, some highly-valuable inventions, which, but for the heavy fines upon inventive talent imposed by our Patent Laws, would long ere this have been brought out, and might have enabled him to have ended his days in much more comfortable circumstances. Mr. J. A. Fanshawe, of Tottenham, died about two years since.

Correspondence.

"CHEMISTIANITY."

To the Editor of the SCIENTIFIC AND LITERARY REVIEW

SIR,—I have much pleasure in informing you that the whole of the work "Chemistianity," now finally revised and reset up in type from the printer's proof book, has been in type some days, and that my printers, Messrs Chas. Willmer and Sons, at 1, Cooper's-row, Liverpool, and of Chester-street, Birkenhead, have this day printed off 2,020 (for 2,000) copies of the first portion of the work, and the remainder will be printed off by about Tuesday or Wednesday of next week, the printing on good paper for books requires four or five weeks to dry. I may safely state on or about the 15th day of October next, as the date of issue.

I deeply regret the length of time I have occupied to complete to my satisfaction my self-imposed task. The causes were my perseverance to make each line correct for chemical truth, and as near as possible for verse, and also a considerable delay in obtaining the proof book back from further correction by different chemical friends Messrs. Stevenson, Blake and Co., of Sheffield, have supplied the whole of the perfectly new type purposely for my book. I have had the paper made specially, and watermarked, "Chemistianity." The whole work is got up in really first-class style, with my best aim for good sense, and will cost me, for the first edition, quite the sum I named—viz., £419.—Yours faithfully,

C. SELLARS, F.C.S., Gas Cement works, Birkenhead.

Office, 2, Woodside Ferry-buildings, Birkenhead.

Monday, August 25th, 1873.

APPLICATIONS FOR PATENTS.

(*Continued from Page 154.*)

and machinery and appliances therefor, part of which machinery is applicable to the preparation and drying of peat for fuel.—B Hunt. Processes for the preservation of food (com.)—W. Clark. Apparatus for utilising wave power for propelling vessels and other purposes (com.) (Complete specification.)—P. P. Girard. Presses for compressing artificial fuel and other analogous materials into blocks.—W. J. Coleman. Compositions for preserving meat, vegetables, fruit, and other articles of food.—W. Gardner and H. Jennings. Door knobs and spindles.—J. Lewis. Machine for cleaning, blacking, and polishing boots and shoes.—J. Mathieson. Construction of and the mode of firing torpedoes.—E. J. Markham. Wheels.

On July 31st.—2590 to 2600.—C. J. L. Leffler. Apparatus or machinery to be employed in rolling metals.—J. R. Whitgreave. Construction of ships and other vessels and boats.—J. Beckett. System of albumenizing paper.—P. Edwards, H. H. Mott, C. F. Mott, and J. Hawes. Appliances for raising and lowering window blinds, partly applicable to other raising and lowering purposes.—F. Hurd and E. T. Sampson. Mode of generating steam and expanding gases combined for motive power, also devaporising steam, and the machinery or apparatus employed therein.—E. T. Hughes. Door calls or bells (com.)—S. Shaw, J. S Sloath, and J. Holt. Machinery for preparing wool or other fibrous substances for combing or spinning.—U. C. Hill. Celluloted bell pianoforte.—F. Barnett. Method of preparing asphalte for paving.—L. Seegers. Apparatus for a gas economiser; an apparatus for increasing the illuminating and heating powers of coal gas with reduced consumption.—G. Haseltine. Preparation and packing of water colours for artists and other purposes (com.) (Complete specification).

On August 1st.—2601 to 2613.—A. Deininger. Production from all vegetable matter containing a fibrous rind (bast-fibre), such as flax, hemp, nettle, &c., of a filamentous matter, which can be used as a filament for spinning, the process doing away with the retting process hitherto in use.—E. Casper Apparatus for supplying water to steam boilers and other vessels, and water purifying apparatus to be used in connection therewith or otherwise (com.)—R. P. Spice and F. W. Hartley. Carburettors.—T. Cobbett. Ball joints.—R. W. Brownhill. Weighing machines for weighing railway trucks, road waggons, and similar purposes, as well as being particularly adapted for weighing coal trucks, minerals, and other colliery purposes and general merchandise.—W. H. Bonnewell. Apparatus for exhibiting advertisements, also applicable to other purposes.—W. Hale. War rocket apparatus.—A. A. Croll and D. C. Dalgairns. Treatment of sulphur ores.—G. C. Lalloy. Cocks or taps.—O Ball and F Jowett Jacquard engines.—W. Betts. Apparatus for ornamenting in colours the sides of metallic capsules.—J. Sibert Apparatus for heating water for generating steam.—J. G Cameron and J Hastie. Steering apparatus.

On August 2nd.—2614 to 2622.—J. S Crosland. Steam boilers.—J Tillot. Apparatus for drying steam, or for separating water from steam.—A. Sonnenschein. School desks and appliances connected therewith.—N D G Galland Permanent ways of railways with heavy gradients and improved rolling stock in connection therewith.—F A Palmer Electro-magnetic engines (com) (Complete specification).—R Chambers. Machinery or apparatus for cleaning wheat and other grain.—W Clark Construction of metallic and other chairs or seats, part of said improvements being applicable for other uses (com.)—E. P. Jones. Ties for securing bales of cotton and other merchandise.—J. B. Walker Improved fuel.

On August 4th.—2623 to 2624.—E. J. Palmer, jun. Ventilating hats.—G. Rydill. Steam boilers and apparatus for utilising waste heat from boiler furnaces on land and sea, and improvements in furnace doors and hot-air tube, also to utilise the heat in the flues and chimneys, and for other purposes.

On August 5th.—2625 to 2631.—P. J Livesey Improved dovetailed joint, and mode or machinery for drawing the same, applicable for constructing drawers, cabinet work, and other purposes (com.)—W. Fundiford. Coupling tin rollers of mules for spinning.—T. W Dunn and O. Prangley. Extracting animal grease and other impurities from wool. T. Shell. Motive-power engine.—J. L. Clark. Apparatus for recording the number of passengers conveyed in public vehicles, and the distance each has travelled.—J. H. Cohrs. Pistons which work without friction, and keep perfectly air-tight.—E. la P. Danielle. Improved article of dress.

On August 6th.—2632 to 2644.—J. Walker. Apparatus for lighting cigars and tobacco.—S. Lang. Fittings of ships' boats, whereby they are rendered self-detaching when lowered into the water.—W. S. Crondace. Night-sight vane for small arms, also applicable to ordnance.—T. L. Phipps. Clippers for clipping horses and other animals.—J. Kirkman. Lubricating packing for the stuffing-boxes of steam engine piston rods, and for other similar joints requiring to be steam, air, or water tight.—T. J. Watson and A. Pegler. Packing for the stuffing-boxes of steam engines, and for other joints requiring to be steam, air, or water tight.—J. Leigh. Manufacture of manure.—S. S. Pollack. Appliance for checking and stopping frightened and runaway horses instantaneously without inflicting any injury on the animal in so doing.—P. R. de F. d'Humy. Means employed for stopping bottles and other similar receptacles.—G. T. Bousfield. Sewing mechanism for sewing machines (com.) (Complete specification.)—W. E Newton. Machinery for moulding bricks, blocks, or other analogous articles composed of plastic or other substances (com.)—E. D Johnson. Preserving steel pens.—W. Clark. Propulsion of vessels and apparatus for the same (com.)

THE EDUCATION OF THE HAND.—The almost marvellous power that may be given to the human hand by training it to the performance of a particular kind of duty has frequently been mentioned in advocating the extension of technical education, and we had a wonderful confirmation of this view at M. Rivière's Promenade Concerts, in the performance on the pianoforte of Mdlle. Marie Secretain. As this young lady has the honour of holding the first prize from the Conservatory of Music at Paris, no further evidence need be sought of her having undergone severe training, or of that training having well-developed her natural powers; yet, one cannot listen to her performance without being astonished at the wonderful power which she possesses over the instrument. The pieces to which we particularly refer are, a powerful solo "Faust" of her own composition, and introducing most brilliant variations upon several of the more popular airs in Gounod's opera, Herz's arrangement of the "Carnaval de Venise," Mozart's Concerto in B flat (andante and finale), Weber's Concerto in E flat, and Weber's Concert Stück. In the performance of these many beautiful and complicated passages, and at the same time extremely rapid ones, were played with a facility and grace which could not be too much admired. Although Mdlle. Secretain is as yet comparatively unknown to the British public, she has done enough to establish her reputation in this country as a charming and highly-talented musician, and we do not hesitate to say that she will long be known amongst us as one of our greatest professional favourites. By the introduction of such high class talent, M. Rivière certainly entitles himself to the utmost possible success.

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THE
SCIENTIFIC AND LITERARY REVIEW,
AND RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,
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*** Communications to the Editor to be addressed to him at 21, Cockspur Street.

CONTENTS.

APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

Further information as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur street, Charing Cross.

On August 7th.—2646 to 2656.—F Harris. Propellers for ships and other vessels (com.)—J. Gillespie Clay pressing machines or presses for the manufacture of bricks, tiles, or other wares therefrom—J. Imray. Anchors (com.)—F W Nolan Seats, particularly applicable for use in theatres and other public buildings.—D Bonds and John Henry Hartnuff Steam pumps (Complete specification.)—P Jensen. Railroad rails (com.) (Complete specification.)—A. Paul Steering apparatus.—J. Woodcock. Machinery or apparatus for punching holes in paper sheets and cards used as pattern in Jacquard machines—J. Turner. Sewing machines—H West Means of locomotion for persons and for effecting the locomotion of carriages, carts, waggons, tram cars, invalid chairs, ploughs, agricultural implements.—T. Robinson. Machines for raising woollen cloths commonly called "gigs."—W. R. Lake. Railway signal apparatus (com.)

On August 8th.—2657 to 2663.—A. Paul. Winches.—J G. Petrie Preserving meat and other articles of food.—J E. Ransome. Ploughs.—F Wirth. Heating apparatus for passenger railway carriages (com.)—W I. Wise. Journals and shaft bearings designed to prevent or reduce friction (com.)—C Rawson, W C Sillar, J. W. Slater, and T S Wilson Treating putrescent or putrescible matters, such as sewage, night-soil, fish offal, blood, and other animal matters and vegetable matters for the manufacture of manure therefrom.—C. Morton Mode of and apparatus for roasting coffee.

On August 9th.—2664 to 2668.—S. Rintoul Apparatus for transmitting motive power.—E. Armitage. Apparatus for measuring and drafting for wearing apparel.—W C. Cottrell. Elevators or apparatus for raising wheat sheaves, straw, hay, and other substances.—W. J Sage. Reservoir or self-supplying writing pens.—J. G. Tongue Seats, benches, and chairs for the purpose of advertising in parks, promenades, and other public places (com.)

On August 11th.—2669 to 2672.—J Imray. Discharging and loading of coals and other goods, and apparatus therefor (com.)—E. T. Hughes. Combined spring berth mattress and life preserver (com.)—T. J Smith System of compensation frames for unimetallic thermometers, clock pendulums, dead standards, and other purposes (com.)—J Hancock. Bobbin net or twist lace machines.

On August 12th.—2673 to 2681.—C. J. Walsh,

Sieves and filters.—J. Goucher. Beaters, beater-bars, or plates for threshing corn and other grain.—W. R. Lake. Apparatus for stretching boots and shoes (com.)—W. Arnold and E. T. Cleathero. Metal dovetailed vice-chair for all kinds of rails and tramways.—R. Stone. Obtaining motive power, and the machinery or apparatus employed therein.—R. Stone. Machine for breaking, crushing, and grinding to powder, stone and other similar substances, also applicable for grinding and mixing clay, peat, fuel, or other like substances, and for surfacing roads.—W. J. Schlesinger. Toy for imitating the notes of singing birds (com.)—R. Carey. Steam engines and pumps.—G. A. Huddart. Means for working railway switches or points.

On August 13th.—2682 to 2692.—J. Wetherill. System or method of drying malt, barley, and other grain, also applicable for drying chicory, roots, or vegetable products, and apparatus to be employed therefor.—E. T. Hughes. Modes of applying castors to sewing machines, furniture, and other articles (com.)—S. Robertson. Dredging, excavating, and elevating machinery.—A. G. V. Harcourt and F. W. Fison. Purification of gas, and the extraction of residual products therefrom.—H. W. Hammond. Mode of and apparatus for driving piles by means of explosive substances (com.) (Complete specification.)—W. Wilson, H. Burch, and J. Battersby. Fingers and finger bar of mowing and reaping machines, and the manner of mounting the fingers upon the said bar.—J. H. Johnson. Umbrellas and parasols (com.)—E. Edwards. Construction and arrangement of platforms, couplings, and buffers for railroad cars (com.) (Complete specification.)—M. Hopkins. Attachments to sewing machines.—E. G. Banner. Disinfecting apparatus.—G. P. Renshaw. Valve gear for steam and other engines.

On August 14th.—2693 to 2698.—H. C. Carver. Steam-boiler and other furnaces.—C. Wood. Manufacture of iron and steel.—G. Openshaw. Card-clothing.—W. Caldbeck. Water-power engine.—D. B. Anthony. Advertising desk or table.—W. R. Lake. Wood pavement (com.)

On August 15th.—2699 to 2714.—J. Hampton. Apparatus for condensing steam and purifying and heating water for generating steam or other purposes.—R. Hadfield. Wheels for tramway carriages.—E. W. Crawley. Apparatus for decantering wines and other liquids.—J. L. Lyster. Jug or vessel for hot water or other liquids.—T. Fox and C. H. Fox. Machinery for dyeing piece goods.—A. Martin. Machines for ornamenting wool and other materials.—O. Burrows. Boot-lasting machine.—R. Stone. Pick excavator and discharging elevator for excavating for foundations, surfacing roads, excavating clay, sand, soil, and other like substances.—G. F. Chantrell. Anchors and kedges for holding and securing ships and other floating bodies (com.)—R. C. Rayson. Looms or machinery for weaving wire gauze.—W. Hunt. Apparatus for marking or scoring at billiards, pool, pyramids, and other similar games, and for indicating the number of games played.—L. Hill. Speed regulating apparatus for marine engines.—J. Barber and J. Ingram. Method of and apparatus for affecting the generation of steam in steam boilers, which invention is also applicable for smelting iron, the manufacture of gas, and other such like purposes (com.)—N. D. Spartali. Construction of steam boilers and furnaces.—A. H. Robinson. Water meters, applicable also to measuring and registering the quantities of liquid withdrawn from casks or other receptacles.—F. Hinton. Manufacture of peat for fuel.

On August 16th.—2715 to 2726.—J. Caldbeck. Means of checking the number of passengers travelling by conveyances, by the combination of new improvements with an old arrangement.—W. R. Lake. Construction of glass furnaces and pots or crucibles used therein (com.)—W. Lowe. Expansion and reversing gear for engines.—E. Bevan. Obtaining filament, fibres, and pulp from vegetable substances.—H. C. Sterne. Apparatus for holding candles in candlesticks.—W. E. Newton. Manufacture of tools for grinding and polishing metals or other hard substances.—J. Andrews. Hanging and driving millstones, and in separating grain and other substances according to size and gravity.—J. Tenwick. Appliances for facilitating the cutting operations of reaping and mowing machines.—W. Pitcher. Means of "craping" hair or other fibrous materials, and machinery employed therein.—C. H. W. Hodgson and J. Needham. Weighing machines.—J. S. Grafton. Mode of evaporating brine, and the apparatus employed therein.—T. A. W. Clarke and E. Turner. Manufacture of packing for glands, and apparatus employed therein, such apparatus being applicable also to other purposes.

On August 18th.—2727 to 2737.—M. Pearson. Looms for weaving narrow fabrics.—J. F. Smyth. Manufacture of gas.—J. W. Freestone and J. Humphris. Process and apparatus for treating spent oxide of iron to extract sulphur and ammoniacal salts therefrom, and for purifying these products, which invention is also applicable for the extraction of grease and oil from seeds and other materials.—W. Brookes. Constructing and supporting and connecting together the rails of railways and tramways (com.)—J. Dean. Fire-places.—J. Lucas and W. Nichols. Machinery and appliances for cutting coal.—J. M Tall. Construction of concrete walls and buildings and apparatus to be used therein.—J. R. Forster. Elastic spigot and socket pipe joint for gas, water, steam, and liquids.—R. Sim and J. Anderson. Knitting machinery.—W. E. Newton. Apparatus for converting a rectilinear reciprocating motion into a rotary motion (com.)—J. C. Gawler. Coupling of railway carriages.

LONDON INTERNATIONAL EXHIBITION OF 1874.

Division 3—Class 14—Recent Scientific Inventions and Discoveries of all Kinds.

List of Committee:—Sir W. Fairbairn, Bart., LL.D., F.R.S.; Major-General Sir Henry Harness, K.C.B.; Sir C. Wheatstone, D.C.L., F.R.S.; F. A. Abel, Esq., F.R.S.; John Anderson, Esq., LL.D., F.R.S.E.; Charles F. Beyer, Esq.; Major Frank Bolton; Frederick J Bramwell, Esq.; Captain Hans Busk, LL.D., F.R.G.S.; Captain Colomb, R.N.; Major W. Crossman, R.E.; Major Donnelly, R.E.; Major E. F. Du Cane, C.B., R.E.; Professor E. Frankland, D.C.L., F.R.S.; Professor T. M. Goodeve, M.A.; John Hick, Esq., M.P.; J. Norman Lockyer, Esq., F.R.S.; John Penn, Esq., F.R.S.; Dr. D. S. Price; John Ramsbottom, Esq.; Professor Roscoe, F.R.S.; C. W. Siemens, Esq., D.C.L., F.R.S.; T. Sopwith, Esq., M.A., F.R.S.; Lieutenant-Colonel Strange, F.R.S.; Professor J. Tyndall, LL.D., F.R.S.; C. B. Vignoles, Esq., F.R.S.

(RULES EXTRACTED FROM THE DIRECTORY.)

51. Division III., Recent Scientific Inventions and Discoveries, will consist of objects the excellence and novelty of which are considered by the committee of selection to be so great as to render it undesirable that their introduction to the public should be delayed until the proper year for the exhibition of their classes of manufacture in division II.

52. No objects will be admitted into division III. which have been shown in previous International Exhibitions of this series, unless very important alterations or improvements have been added to them since the date of their previous exhibition.

53. To assist the committee of selection in judging of the qualifications for admission of any invention submitted for exhibition in division III., it is desirable that the form of preliminary application (No. 10) should be accompanied by a statement of the inventor's special claims to novelty and excellence, and (if possible) by the written opinion of some scientific gentleman of repute who has practically examined the invention.

54. The Act of Parliament for the protection of inventions exhibited at the Annual International Exhibitions is entitled "The Protection of Inventions Act, 1870," 33 and 34 Vict. chap. 27, and dated July 14, 1870.

57. The latest day appointed for receiving objects in this division is Wednesday, 11th March, 1874.

7. Applications to submit objects, proposed for exhibition, to the official committees of selection, should be made on the form of preliminary application (No. 10), which can be obtained at the offices, 5, Upper Kensington Gore, London, S.W., and should be forwarded to the secretary before the 1st of January, 1874.

DEATH OF CORNELIUS VARLEY.

We have to record at the great age of nearly 92 years, the death of this scientific veteran, who departed this life on the 2nd October, 1873. He was one of the earliest members of the Inventors' Institute, and many must remember his familiar voice at its meetings, for his knowledge of practical science was so varied, that on almost every subject he had some information to give which was always serviceable to the cause of scientific truth. He was one of a family of five, his elder brother being John Varley, the father of water-colour painting; his younger sister was married to the elder Mulready. His mother's maiden name was Fleetwood, a direct descendant from General Fleetwood, who married Oliver Cromwell's daughter. Having lost his father when he was ten years of age, his uncle, Samuel Varley, took charge of him, and taught him mechanics, optics, and chemistry. In 1794 his uncle and himself began a series of chemical experiments; and eventually Cornelius Varley devised the method of polishing lenses upon a mixture of beeswax and oxide of iron, the method generally employed by opticians at the present day. Cornelius Varley made several improvements in microscopes and lenses, he also made the first diamond microscopic lens; and exhibited it at one of the meetings of the Royal Institution

In the year 1800 he joined his elder brother, John Varley, who taught him to draw from nature, and the Earl of Essex introduced him to his first pupils.

In 1808 he and seven others, among whom was Turner, the painter, formed a sketching society to meet at each other's houses. In 1809 he invented his "graphic telescope," an ingenious and very useful instrument, and Mr. T. Horner purchased three, with which, from the top of St Paul's Cathedral, he traced the panorama of London in true perspective, for the Colosseum in Regent's Park. In 1821 he married Miss E. L. Straker, and had issue, seven sons and three daughters, four sons and three daughters being now living, amongst whom are Mr. Cromwell F. Varley, the well-known electrician, and Mr. F. H. Varley, C.E., the chairman of the Ordinary Council, or Executive, of the Inventors' Institute. In 1822, he was offered the governorship of some mines in Brazil It was an honourable and lucrative position, and of considerable importance to him at the time. A ship was being fitted out for him, his family, and staff, when he discovered that slaves were to be employed in the mines; he at once threw up the appointment in an instant, an action thoroughly characteristic. He was an active co-operator with the Royal Institution in its early days, and delivered the fourth Friday evening lecture there, on the 24th February, 1826. By marriage, he was a family connection of the late Mr. Faraday. He was also one of the founders of the Royal Microscopical Society.

He was an active worker, his recreation being to watch and advance science and art. His memory was wonderful, and brilliant to the last. Few could converse with him without receiving instruction.

Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE.

NOVEMBER 1, 1873.

INVENTION AND ADULTERATION, AND SIMULATION.

To our mind the gift or faculty of invention is the most God-like of all the attributes of man. Creation, in its high sense, is one with invention, which is usually acknowledged to be Divine, notwithstanding all that neoteric philosophers, plagiarising their pagan predecessors of ancient days, may trumpet forth as novel and true in regard to development, evolution, natural selection, and the like.

But high in the order of things as may be the place of invention, yet it seems we must not, when it is possessed by human beings, consider it as exempt from liability to debasement, for experience has shown us that the inventive faculty may be so perversely misapplied as to lend its aid not only to foolish projects, which may prove injurious to the pecuniary welfare of many individuals, but it may even be exercised on behalf of matters which are not only immoral, but legally criminal; such, for instance, as the invention of instruments of burglary, or, what is perhaps more common, invention may afford its aid to the adulterator of our meats and drinks, or the simulator of the Spurious for the Genuine.

Most of us have heard of the Dutch butter, which was said to be made from the filthy mud of the banks of the Thames, and some may perhaps be aware that not long ago, before the very properly stringent laws now in force were enacted, machinery for cutting and shaping chicory into simulated coffee-beans was the subject of a patent application, which, we believe, was, as was only proper—objected to by the Crown law officers as conducing to the carrying on of unlawful practices.

Although we are not inclined to attach the character of baseness to the matter we have now to bring before our readers, yet we feel it our duty to deprecate the application of invention to such matters as that one which has recently received commendatory notice in that well-known and highly respectable journal, the *Scientific American*, which, by-the-bye, although a journal of inventions, has, according to some of its recent utterances, some very unsound notions as to the true basis of property in inventions, which, according to its views, are *evolved by spontaneity* rather than produced by creation. The invention we refer to has, it appears, received practical development, and obtained a certain commercial *status* in the United States of America, although claimed for a Frenchman as originated by him. This "invention" is the scientific production in a regular and systematic way of butter from fats, for though the inventor is said to restrict himself to beef suet, yet we cannot help thinking that what will happen if great commercial success be desiderated by the promoters of this new industry is, that beef suet will not be the only substance operated upon, to obtain the olein which is required, and that in our shops a very definite and prominent distinction between butter from natural milk, and the olein butter from the butter factory, will not be strictly maintained unless our penal laws are found sufficient to deal efficiently with the new traffic—of course, if from considerations of cheapness or otherwise, consumers should prefer the factory-made butter, we don't see who has a right to interfere, seeing that nothing deleterious is introduced into the new article; but the public must be stringently protected against the newly-invented article being passed off as the old-fashioned butter made from our dear old friend—the cow's veritable milk—for it may be safely maintained that the new-fangled article is *not equal* to the old-established favourite.

The above-mentioned journal devotes to this subject a large portion of the space of one of its recent numbers showing—First, that milk is a mechanical mixture of butter, casein, and water, the latter holding in solution sugar of milk, or lactin, and several salts. The butter being held suspended in the milk by the caseous or cheesy matter, and the whey, with which it is intimately blended. That milk is a true emulsion, resulting from a mixture of these three ingredients, and owes its opacity and white colour to the diffusion through it of the butyraceous oil. That particles of butter in milk consist of very minute globules 1-2500th inch in diameter, suspended in the surrounding serous fluid. And after detailing the usual process of butter making, thence proceeds to detail the particulars of the manufacture of artificial butter by a Hashing machine which chops up and grinds washed suet. By steaming vats, and by presses for expressing the olein. And the article concludes with the following remarks favourable to the character of the new butter:—

We tasted some of the butter thus made and prepared for the market. With the exception of a slight granular consistency, we could perceive no difference between it and good ordinary firkin butter. This peculiarity, it is stated, disappears after keeping for some length of time.

The butter made in this way can be afforded much cheaper than the ordinary article, but it must not be supposed that the cow's occupation is for ever gone. Suet is an article the supply of which is limited, and it is only in large cities, or localities where beef cattle are largely slaughtered, that it will prove profitable to engage in the manufacture of this artificial butter. The company expect, we were told, to enlarge their works to the capacity of some twelve tons of butter per day. This is only about one-tenth the quantity daily consumed in the city of New York.

The butter made can be transported to and will keep in warm climates, owing, as before stated, to the absence of the readily putrescible compounds existing in ordinary butter. Shipments have already been made to South America; and as regards home consumption, it is said that hotels in this city, and even a fashionable club, are customers of the company for this artificial butter.

THE BRITISH ASSOCIATION.

(Concluded from our last.)

SEPTEMBER 18.

ECONOMICAL SECTION.—Mr. Hyde Clarke read a paper on "The Influence of Large Centres of Population on Intellectual Manifestations," which did not attract so much attention as the importance of the subject seemed to demand. Mr. Haughton followed with a paper on "Railway Amalgamation." The discussion on this was very interesting, both Lord Houghton and Mr. Forster taking part in it, the former particularly condemning the State purchase of railways, though he was rather strongly in favour of amalgamation. Some considerable surprise was expressed at the large figures used by Mr. Binns in describing the receipts of Bradford building societies, which seemed to be in a much more flourishing and prosperous condition than is generally known. Much interest was shown in Mr. Hanson's paper on "The Educational Statistics of Bradford," in which he strongly condemned the half-time system, and maintained that the educational results of legislation were by no means commensurate in Bradford with the expenditure. A pitched battle was fought on these points between Mr. Fitch and Mr. Forster on one side, and the writer on the other, the former maintaining that the half-time system, if not desirable in itself, was at least a necessity of the times, while the educational return, large and increasing as it was, gave much cause for satisfaction with the results of recent efforts.

BIOLOGICAL SECTION.—The inaugural address by the President, Dr. Allman, was of considerable interest, though the new ground broken up was not extensive. The discovery of order among a chaos of seemingly disconnected facts is perhaps the highest attainment to which science can make pretensions, and must always precede, as indeed it alone can render possible, that power of predicting future events, which is more striking to the popular mind. The difficulties in the way of the natural classification of the animal kingdom are no fewer nor less important than those in other branches of science, and the lecturer followed at some length the steps by which many of these have been overcome. These steps resolved themselves mainly into two, a study of the anatomy and of the development of animals. By the anatomy it is possible to distinguish between forms, which like some of the protozoa cœlenterata, show no difference from one another appreciable to the naked eye; but this method utterly fails if it be attempted to apply it to an organism which, like the sacculina, has no structure whatever. But where the anatomy proves of no use, development comes to our assistance, for the egg of this animal, if watched, will be found to develope into a creature closely allied to the common barnacle, and its affinities at once become known. On the subject of Darwinism, which also obtained some notice from Professor Phillips in his address to the Geological Section, Dr. Allman made some shrewd observations. Though admitting, at least by implication, the principles on which the theory is based, he remarked that the great difficulty in the way of accepting the system as a complete account of the animal world, is the great and even enormous lapse of time necessary for the required changes to take place. During these intervals the whole existing series of animals might, he showed, become extinguished, and it might so be necessary for the development to start afresh, and what particular direction this might take it would of course be impossible to predict.

Quite an interesting discussion arose on a sudden on Dr. Fothergill's paper "On the Relation between Brain Work and Blood Supply," Dr. Carpenter, Dr. Ferrier, and Dr. Crichton Browne following one another in rapid and animated succession. It is difficult to realise, on the first presentation of the new idea, that complicated mental phenomena and brilliantly imaginative evidences of intellectual power can be resolved into such physical conditions as an increase of blood supply to the brain; yet such is undoubtedly the tendency of modern investigation as exhibited both in the paper of Dr. Fothergill, and in those experiments by Dr. Ferrier, the interesting details of which were presented to the public in the Biological Section.

MECHANICAL SECTION.—Mr. Newton's paper on Tilghman's sand blast process for cutting hard substances was read, and excited much interest.

SEPTEMBER 19.

GEOLOGICAL SECTION.—Dr. Pengelly occasionally animates the dry bones—or should we not in this section say the dry stones?—of science with his overflowing humour. Thus, to illustrate his great familiarity with Kent's Cavern, he told how that the natives around that place were accustomed to say that he walked there every day, a distance of three miles, and that on one occasion, when he was too ill to go, his boots, from the force of habit, started off and went on their own account. No bootless errand either, we should say. But his story in reference to the untold length of geological periods was even better. A good man, with a lingering prejudice in favour of the popular Biblical notion of six thousand years as the age of the world, button-holed the doctor, and implored him to say distinctly whether he really did believe the ages that he talked of to be longer than the orthodox 6,000. He replied that his friend might add to that number as many noughts as his fancy dictated, and even then not to make it *naughty* enough.

Professor Williamson's lecture on coal and the coal plants, well delivered and fairly exhausting the subject as at present understood, brought to a close an interesting and exciting day.

BIOLOGICAL SECTION.—Dr. Rutherford delivered his address to this section. The controversy concerning a Vital Principle is one of old standing, and raged before Bichat defined his view of life as "Organisation in Action," but Dr. Carpenter was probably justified in saying that more time than was necessary was spent by Dr. Rutherford in demolishing the already upset notion that the Vital Principle is an entity behind those phenomena which go to make up what we understand by the expression. The substitution, however, of the expression vital force proposed by Dr. Carpenter did not go far to remove the difficulty. As usual, it was more easy to illustrate than to explain a difficulty, and when Dr. Rutherford asked how it happens that a mass of hepatic protoplasm, for example, will secrete bile, while a similar mass in the stomach will produce gastric juice, his question was more felicitious than its answer. The tendency of science in all directions is indeed to displace, or at least to push back step by step, those theories of phenomena which imply some hidden essence or entity behind them. The explanation of the classical and subtle Greek that the to him extraordinary phenomena witnessed in a running stream, a living tree, or a springing fountain, must be found in the God he supposed to animate them, is an idea which has not exactly approved itself to modern science, neither is it disposed to view more favourably a notion which, like the one revived for the time by Dr. Rutherford, evidently belongs to the same category, and would compel it to transcend that region of phenomena which is its only province. Whether science will always confine herself purely to the phenomena, or whether she may not attempt one day a more complete explanation of the universe, or whether she will always have to face the admission that difficulties thrust back are not therefore solved, are some of the general questions of the future which give to that raised by Dr. Rutherford its main if not its only importance. As the time approached for the delivery of Dr. Ferrier's paper—he is not, by the way, any relation, as has been stated, of Christopher North—the lecture hall became more and more crowded, until at last ingress and egress were both alike difficult. The crowd here was even greater than in the Economic Section, though that at some periods of the day was well filled. For various reasons, partly because the human brain was to be discoursed upon, partly because it was thought the popular subject of phrenology was to be referred to, and partly because it had been more than hinted that some new and striking facts were to be made known, the general interest in Dr. Ferrier's paper was greater than in any other subject during the day. Nor, although the lecturer occupied two hours in the delivery of his remarks, did the interest once flag. Describing first the general aspect of a human brain, Dr. Ferrier proceeded to the comparative anatomy, remarking that as the brain is examined in a series of animals it is found, though constructed on the same general principles and having analogous parts, to vary much in the number and complexity of the convolutions and in the development of parts. Referring them to the experiments which were performed in Germany three years ago, in which certain movements were observed to follow on irritation of various parts of the brain, he explained the manner in which his own investigations had been carried out. Much interest was shown as he related how he had been led on from one step to another, until he was able to predict almost infallibly the succession of certain definite movements on irritation of known portions of nervous tissue. From the remarks of the speaker it was inferred that much yet remained to be stated had time permitted. As it was, the interest excited was intense and widespread both among the public and members of the section who have made a special study of physiology. Such results stated on the authority of experiments carefully conducted could not fail to excite an animated discussion between several prominent members of the association, among them Dr. Haley, Dr. Carpenter, Dr. B. Sanderson, Dr. Crichton Brown, and Dr. Brunton, rose one after another.

Mr. Tylor's paper on the Relation of Morality to Religion in Early Stages of Civilization was remarkably able, and the discussion that followed well worth hearing; Mr. Moncur Conway's remark that early races had no devil because their deity served them for an evil spirit as well as a good, being very shrewd, and seeming to excite great attention.

CHEMICAL SCIENCE.—This section met in the Unitarian School-room, Chapel-lane, the president, Professor W. J. Russell, in the chair.

Professor G. C. Foster, F.C.S., read a report on a new pyrometer. He said the report was more properly on Siemen's pyrometer, but this pyrometer was so little known to practical men that it might be called a new one. The action depended on the decrease in the conductivity of a platinum coil when it was heated. When a coil was hot the freedom with which an electric current was transmitted decreased, and by measuring that decrease with an electrometer the temperature was ascertained. The convenience of this pyrometer lay in the ease and accuracy with which that decrease could be measured. He need not point out the importance of those measurements of furnace temperature for which the instrument was chiefly intended. A committee of the association was appointed to examine its applicability to this purpose, and one of the first points examined was whether it always cooled back to the same zero point. It was ascertained that it did not—that every time

the heating and cooling down was repeated there was a permanent rise in the zero point. Professor Williamson had found that platinum underwent a change when heated with silica in a reducing atmosphere; this, of course, modified the conducting power of the wire. Mr. Siemens endeavoured to remedy this by surrounding the platinum wire with a platinum tube, an iron tube being placed outside of all. Unfortunately, however, their experiments did not show that this had any particular efficiency in doing away with the defect in question. In their experiments it had been found that a coil whose resistance before heating was 9·938, and at the extreme temperature attained 31·0, when cooled down again showed instead of a resistance of 9·938 one of 10·465, and other trials showed an equal permanent change. Thus there was not that improvement which was hoped for. Nevertheless, although the scientific value of the instrument was not great, it was yet of great practical advantage. The committee hoped, if appointed for another year, to make further researches.

In reply to a question, Professor Foster said that they had not this year experimented on the point as to whether the advance in the zero point was progressive, or whether after a great number of heatings there was a tendency to fixity of the zero point. Last year, however, they noticed some such tendency with a pyrometer which had been heated fifty times.—The President asked what temperature would be indicated by the advance from 9·938 to 10·465, if it were caused by increase of temperature instead of a permanent advance of the zero point. —Professor Foster replied that it was very small indeed.—In answer to other questions, Professor Foster said that he could not say whether one long-continued heating produced the same effect on the zero point as several briefer heatings. The highest temperature employed in the experiments was that of a common fire burning briskly. Experiments made by Professor Williamson had shown that the change in the zero point was due to the alloying of the platinum with silica.—The President observed that the pyrometer must be of great practical use, despite the error which was their difficulty, when in experiments with such high temperatures the error only amounted to some 1·5 degrees.

Mechanical Science.—This section met in the Chuch Institute, under the presidency of Mr. W. H. Barlow.

The president, in opening the proceedings, announced that the president of the Chemical Science Section would take all papers on sewage on Monday, at half-past eleven, and after the section meeting had closed for the day, the Corporation of Bradford would throw open their sewage filtration works at Bolton for inspection.

Mr. F. J. Bramwell, C.E., F.R.S., then read an interesting paper on Huggett's System of Manufacturing Horse-Nails. About seven years ago Messrs. Huggett entered on the manufacture of nails. They applied to Mr. Moser, a well-known iron-merchant. He supplied the capital, and they had now been trying for seven years. For three years a plan had been worked which gave great prospect of success, and produced a nail which to the eye of any but the experienced farrier was perfect, but which possessed certain imperfections which rendered it practically useless. All the expense incurred in erecting this machinery was therefore thrown on the scrap heap. A totally different plan by the same inventor produced a perfect nail. But although the nail was perfect, the machinery knocked itself to pieces, and after two years' trial, this also had to be abandoned. Messrs. Huggett again applied to Mr. Moser, and he, nothing daunted, still persevered in his effort, but determined to fortify himself with a practical opinion, and applied to the author of that paper, Mr. Bramwell. His advice was given, and £5,000 was invested in making another trial. The expenditure proved the advice to have been sound, the process was a commercial success, the nails were as good as the hand-made ones, and the machinery was not injuriously affected. The Swedish nail-rods, which was the only description of iron which ought to be used for the purpose, were first placed in a Siemens' furnace, where they were heated to a high welding heat in thirty seconds. This furnace was, he believed, necessary to the success of manufacture, as it was in the highest degree essential that the iron presented to the rolls should be of uniform size. The waste which took place in the ordinary furnaces not only had the effect of destroying the material, but the efficiency of the machine would be affected by the diminished size of the rods, so that full-shaped nail blanks could not be obtained. The Siemens' furnace, therefore, by its property of heating without oxidising, fulfilled every requirement. The rods thus heated were then thrown into the rolls, which run at 550 revolutions per minute, where they were shot through and were changed from parallel rods of about 2 ft. 6 in. long to rods about 7 ft. long, made up of alternating prominences and thin spaces; each prominence or thick part when finished forming two heads, and each thin part forming two shanks. The prominences on the rods were then flattened by being put edgeways through a pair of rollers. These spread out the prominences and make the necessary projections on the edge and side of the shank to form a head. This was done cold. The rods were then taken to the cutting machine, which at one operation cut the rods through, both for the head and the point, at the same time making the point. The separate nails were then examined and the imperfect ones rejected. They were then annealed, and afterwards "rumbled," or worked together in a revolving cylinder, for seventy-two hours. The nails were then taken to the heading machine, the lower part of which consisted of a wheel capable of revolution containing twelve pairs of dies. The nails were inserted in these dies and then the wheel, making an intermittent revolution of one-twelfth, brought in succession a pair of dies with its nails under the action of a heading tool, resembling the "tup" of a steam hammer, which was brought to bear on the nail by cam action. While this was taking place the two halves of the dies were held together by pressure. After the head had thus been formed, the holding action was taken off, the wheel made another twelfth-part of a revolution, and the headed nail was discharged by the blow of a mechanical hammer. The nails, after being again annealed, were taken to the shaping machine, which was practically similar to the heading machine excepting that it had a pair of side dies as well as an upper and lower die. They then went through another sorting, were rumbled for seventy-two hours with black-pot (powdered crucibles), were again rumbled for seventy-two hours in water only, and finally were blued by being exposed to a gas flame in a revolving cylinder, precisely like a coffee roaster. It was supposed that there were three million horses in Great Britain and Ireland. These required one thousand million nails a year. These were now made by hand at a cost of about 3s. 3d. per thousand for number tens, the standard size. The "applied labour" in producing nails by this process, as it was carried on at present in the suburbs of London, was only ninepence a thousand. The plant at present in use was capable of turning out five tons of these nails per week, and great extensions were contemplated.

Mr. Thos. Webster, Q.C., F.R.S., said the process introduced to their notice by Mr. Bramwell reminded him of the time when wool was combed by hand. Just as that industry was formerly, the making of horse-nails was still carried on under conditions unfavourable to health. He thought that the introduction of machinery for the manufacture of horse-nails would lead to as comparatively great and good results as had followed on the perfection of combing machinery. Mr. W. E. Newton said that it was easy enough to make a horse-nail by machinery, but it was the firm belief of competent authorities that it was an essential that a horse-nail should be forged, and he contended that the nails made by this process were simply cut nails. Machinery for making forged nails was in successful use in America, and an American inventor's machine was now being made at Leeds, and would shortly be finished. In this machine the action closely resembled the process as followed out by hand. Mr. E. H. Carbutt remarked that the perseverance which had been displayed in perfecting this process was worthy of all the success which promised to attend its introduction. Mr. Richardson, of Oldham, made a few remarks as to the value of the Siemens' furnace for small work. Mr. J. A. Huggett said that the idea that a horse-nail must necessarily be forged was exploded, as the nail rods after having been rolled in the manner described in the paper would stand even more bending and twisting than a hand-made nail. He also gave some particulars as to the cost of production. Mr Bramwell, replying to Mr. Newton's remark, said that these were not cut nails in the sense in which the term "cut nails" was usually understood. It was no more correct to apply this term to them, than it would be to say that an axle was a cut axle because it had been forged and had had its ends cut off. (Applause.)

On September 19th, papers in Sections A, B, C, and G.—

Section A.—Mathematical and Physical Science.—Professor R. Stawell Ball—To Exhibit and describe Dynamometers; Professor Forbes—On Irradiation, on Certain Connections between the Molecular Properties of Metals; Professor Zenger—On the Correlation between Specific Weight and Specific Heat of Chemical Elements, On the Action of Symmetrical Conductors and Lightning Conductors; F. H. Wenham—On the Influence of Temperature on the Elastic Force of Springs; Arthur Schuster—On the Effect of Pressure and Temperature on the Widening of the Lines in the Spectra of Gases; W. G. Davis—On some Abnormal Effects of Binocular Vision; G. M. Whipple—On a New Form of Rutherford's Minimum Thermometer; C. J. Woodward—On a New Form of Oxy-hydrogen Lantern.

Section B.—Chemical Science.—Professor Williamson, F.R.S., Report of the Committee for Superintending the Monthly Reports of the Progress of Chemistry; Professor G. C. Foster, F.R.S., Report on a New Pyrometer; W. Chandler Roberts, F.C.S.—Report on the Method of Making Gold Assays, and of stating the results thereof; J. Dewar, F.R.S.E., Report on High Temperatures; A. Vernon Harcourt, F.R.S., and F. W. Fison, F.C.S.—On a Continuous Process for Purifying Coal Gas, and Obtaining Sulphur and Ammonium Sulphate; C. J. Woodward, F.C.S., B.Sc.—A New Form of Gas Generator; J. Spiller, F.C.S., An Artificial Magnetite; Dr. Paul and A. D. Cownley, F.C.S.—On the Valuation of Commercial Crude Anthracene.

Section C.—Geology.—W. Pengelly, F.R.S.—Ninth Report of the Committee for the Exploration of Kent's Cavern, Torquay; W. Boyd Dawkins, F.R.S., Report of the Settle Cave Committee, Note on the Rate of the Increase of Stalagmite in the Ingleborough Cave; Dr. Leith Adams—Concluding Report on Maltese Fossil Elephants; W. Boyd Dawkins, F.R.S.—The Relation of the Pleistocene Mammalia to the Glacial Period; Rev. H. W. Crosskey, F.G.S.—Report of the Boulder Committee; W. Gomersall—The Round Boulder Clay Hills of Craven; W. T. Blanford, F.G.S.—On some Evidence of Glacial Action in Tropical India

in Palæozoric, or the Oldest Mesozoic Times; J. E. Taylor, F.G.S.—The Occurrence of Elephant Remains in the Basement-bed of the Suffolk Red Crag; Professor Harkness, F.R.S.—On Faults in the Permian Sandstone in the lower portion of the Vale of Eden, Cumberland.

Section G.—Mechanical Science.—Report and Rainfall Committee; Report of Committee on Instruments for measuring the Speed of Ships; James R. Napier, F.R.S.—On Napier's Pressure Logs; Rev. E. L. Berthon—On the Hydrostatic Log; F. J. Bramwell, C.E., F.R.S.—On Huggett's System of Manufacturing Horse Nails; Charles Gott, C.E.—On the Bradford Waterworks; Joseph Wilcock — On the Bowling Ironworks; Thomas Webster, Q.C., F.R.S.—On the Assimilation of the Patent Systems of Great Britain and of the United States. No noticeable discussion ensued on the reading of this paper.

SEPTEMBER 20.

GEOGRAPHICAL SECTION. — Mr C. R. Markham's paper on "Recent Arctic Explorations" was the centre of attraction, and it was matter for regret that—owing to the fact of Mr. Forster's address being down for the same time—the attendance, though full, was not so great as it would otherwise have been. The writer advocated further Arctic expeditions, maintaining the existence of an open Polar sea, which would not, therefore, be found so dangerous as seemed to be commonly supposed, and pointing out that the cause of the failure of Captain Hall's expedition was chiefly to be referred to want of discipline in the crew and to the fact that it was not under the command of a regular naval officer. A regular Arctic naval station would not, he said, be found more dangerous than any other—there was an abundant supply of fresh meat in the presence of musk oxen, and the advantages of such a station would be very great indeed. A good deal of excitement was manifested when Captain Markham described how he picked up the crew of the *Polaris*, though, from the circumstances of the case, not much information could yet be made public on the subject. In the discussion which followed several prominent members took part, among them Dr. Carpenter, Admiral Ommanney and others.

MATHEMATICAL AND PHYSICAL SECTION. —Professor Clifford's Report of the Committee on Elementary Geometrical Teaching attracted some attention, but the section somehow did not seem to be in the humour for the discussion on it, which soon fell through. It is this fate of the section sometimes to deal with abstruse subjects, information on which is by no means widely distributed, and a number of papers difficult to understand followed one another, on Hyperelliptic Functions, Modular Equations, &c. Mr. Hanlon read a paper on some suggestions toward the formation of extended tables of Logarithms, which he proposed to obtain by getting the pupils in schools throughout the country to work the Logarithms in the form of arithmetical questions. This suggestion was justly handled very severely by all the members who took part in the discussion, the president of the section going so far as to say when he first heard of the idea he supposed it was a joke. It seemed evident that the trouble of verifying such tables, and the cost entailed in obtaining them, would be much greater than the more effectual method of employing experts to do the work.

BIOLOGICAL SECTION.—The only Department in which a meeting took place on Saturday was that of Anatomy and Physiology. Dr. Burdon Sanderson read an interesting paper "On the Electrical Phenomena accompanying the Contraction of the Cup of Venus's Fly-trap." This plant has a peculiar formation of leaf, the two halves of which are jointed on one another at the midrib, and are fringed externally with long hairs. On the application of an irritant the two parts come together, retaining enclosed between them any small body which, like an insect or fly, may chance to be resting on the surface. Dr. Sanderson showed that when this action took place it was accompanied by the exhibition of electric phenomena analogous in their nature to those which occur when nervous and muscular actions are induced in animals, and he thus pointed out a striking confirmation of the universality of the laws which obtain in all organised structures.

GEOLOGICAL SECTION.—On Saturday, there was somewhat of a Slaughter of the Innocents, none of the papers eliciting much general interest. In the afternoon a party of about thirty or forty members, including the president of the section, Mr. Pengelly, and others, went to Settle at the invitation of Mr. John Birkbeck, of that place, to see the Victoria Cave, where important discoveries of bone fossils have lately been made. After an elegant luncheon the party climbed the hill in the midst of a drenching rain, and inspected the cave. Mr. Boyd Dawkins, Mr. Tiddemann and Professor Hughes explained the formation of the strata and the discoveries which had been made, and a lively discussion took place between the two latter gentlemen as to whether the bones which had been found belong to the pre-glacial or post-glacial period. The party afterwards went to inspect the collection of specimens found in the cave, and which are preserved by the care of the Rev. Geo. Style, the head master at Giggleswick Grammar School.

The papers on Sept. 20th, the above included, comprised in A and C sections:—

Section A.—Mathematical and Physical Science. J. W. L. Glaisher—Report of the Committee on Mathematical Tables; Professor Clifford—Report to the Committee on Elementary Geometrical Teaching; W. H. L. Russell—Report on Hyperelliptic Functions; J. W. L. Glaisher—On the introduction of the Decimal Point into Arithmetic; Professor H. J. S. Smith—On Modular Equations; J. W. L. Glaisher—On Propositions in the Theory of Numbers deduced from Elliptic-Transcendant Identities, Professor Ch. Hermite—On the Irrationality of the Base of Hyperbolic Logarithms; J. W. L. Glaisher—On the Negative Minima of the Gamma Function, Professor Cayley—On the Mercator's Projection of a Surface of Revolution; W. Spottiswood—On Triple Tangent Planes; Professor Clifford—On Some Curves of the Fifth Class; S. C. Tisley—A Compound Pendulum Apparatus; Professor Clerk Maxwell—On the Relations of Geometrical Optics to other Branches of Mathematics. On the Final Equilibrium of a System of Moving Molecules; Rev. Henry Wace—On the Calculation of Logarithms; G. O. Hanlon—Some Suggestions towards the Formation of an Extended Table of Logarithms; Professor Harley—On the Theory of Differential Resolvents; On Professor Evan's Method of Solving Cubic and Binomial Equation of all Degrees; Professor Ball—Further Contributions to the Theory of Screws; Geometrical Solution of the Problem of the Impulsive motion of a Body having Three Degrees of Freedom; Professor Clifford—On a Surface of Zero Curvature and Finite Extent; Professor Everett—On the Kinematics of a Rigid Body.

Section C. — Geology. — J. Thomson, F.R.S., report on the Investigation of Carboniferous Corals; J. E. Taylor, F.G.S., the Occurrence of Elephant Remains in the Basement-bed of the Suffolk Red Crag; Professor Harkness, F.R.S., on Faults in the Permian Sandstone in the lower portion of the Vale of the Eden, Cumberland; Professor A. S. Herschel, F.R.A.S., and G. A. Lebour, F.G.S. Notes on some Experiments on the Conducting Power for Heat of certain Rocks; W. Topley, F.G.S., and G. A. Lebour, F.G.S., on the Whin Sill of Northumberland; T. Moffatt, M.D., F.G.S., on Geological Systems and Endemic Diseases.

SEPTEMBER 22.

MATHEMATICAL AND PHYSICAL SCIENCE. —This section met in Horton Lane School-room, at eleven o'clock, the President again in the chair.

Professor Everett read the report of the Committee on Tides, and also of the Committee on Underground Temperature.

Mr. G. J. Symons read the report of the Rainfall Committee.

Mr. Newton explained to the section the action and various applications of the sand-blast process. It was stated in answer to a question which had been asked when the process was before Section G, that the sand-blast could be applied to the removal of the incrustation from the interiors of boilers. Other questions were asked, and some discussion took place.—Professor Reynolds afterwards read a paper on certain phenomena of impact, an explanation being given of the cause of the efficacy of the sand-blast.

Professor Herschel stated the results of some experiments on the conductivity of rocks. The means by which he had endeavoured to get some certain results on this point were the enclosure of a box of heated water in non-conducting material, and in contact with the rock whose conductivity was to be tested A delicate thermo-electric pill then measures the amount of heat conducted by the stone. Professor Herschel said that results of very great value had not yet been attained with certainty Amongst other things, however, it had been ascertained that shale had a very low conducting power.

CHEMICAL SCIENCE.—This section again met in the Unitarian School-room, and the proceedings were begun by Dr. Paul, who read a paper, the work of himself and Mr. A D Cowley, on the Valuation of Commercial Crude Anthracene.

Mr. J. Norman Lockyer then brought before the section the subject of the elements of the sun. His object was to obtain the assistance of chemists in dealing with the sun and stars.

Mr. R B Grantham, C.E., brought up the report of the Committee of the Association on the Treatment and Utilisation of Sewage.

GEOLOGY.—The section opened this morning by the President calling on Mr. L. C. Miall to read his report on the Labyrinthodonts of the Coal Measures.

The first part of the report, dealing with the general structure of the group, was presented. A large number of valuable and important examples of carboniferous labyrinthodonts were exhibited.

This was followed by a short note by W. Horne, on the Occurrence of Fish and Amphibious Remains in the Yoredale Rocks of Wensleydale, drawing attention to a fine collection of fish remains exhibited by the author.

The report on the British Fossil Crustacea was read by Henry Woodward, F.R.S.

A paper on some New Species of Phyllopodous Crustacean, belonging to the Genus Dithyrocaris, from the Carboniferous Series, with notes on others already described, was read by H. Woodward; and related to the discovery of some fossil shrimp-like animals in the coal measures. It was shown that certain so-called new forms were only peculiar fossils which had already been described.

Henry Woodward, F.R.S., F.G.S., read a paper on New Facts bearing on the inquiry concerning Intermediate Forms between Birds and Reptiles, drawing attention to the question—so much discussed of late—of the significance attaching to the relationship of birds to reptiles; and pointed out that, wide as is the gap existing between Aves and Reptilia, yet, nevertheless, there is

as a whole scarcely greater disparity between some birds and some reptiles than exists between the Chelonia, the Enalio-sauria, the Plesiosauria, and the Lacertilia.

Mr. H. Hicks, M.D., read a paper on the Arenig and Llandeilo Rocks of St. David's.

Mr. John Hopkinson, F.G.S., read a paper on some Graptolites from the Upper Arenig Rocks of Ramsey Island, St. David's.

A paper was read by Mr. J. Hopkinson on the Occurrence of numerous Graptolites in the Ludlow Beds of Shropshire. It stated that until recently only two species of graptolites were believed to occur in the Ludlow rocks of Shropshire. Another species was added by Dr. Nicholson in 1868. Mr. Hopkinson now described several new species. One or two forms hitherto supposed to be characteristic of one or other divisions of rocks had not been found in them. The author then particularised the new species, which, he said, characterised distinct zones. He concluded by showing that the Ludlow Rocks of Shropshire possessed a rich graptolitic fauna.

Professor Harkness and Mr Gwyn Jeffreys made a few remarks, to which Mr. Hicks briefly responded.

Mr. J. L. Lobley, F.G.S., read a paper on the British Palæozoic Arcadæ.

Biology (Department of Anatomy and Physiology).—A paper was read by Dr George Harley, on the Formation of Renal Calculi (Professor Rutherford, vice-president, in the chair). After showing that a calculus, or concretion, may be formed in any part of the body, he referred especially to those formed on the kidney, dividing them into the organic and inorganic.

A paper on the Diverticulum of the Small Intestines in Man, considered as a Rudimentary Structure, was read by Professor T. A. Struthers.

A paper was read by Mr. E. Ray Lankester on the Growth of the Ovarian Egg, and the Early Development of the Cephalopod Loligo. A report of it, without the aid of diagrams, would be almost unintelligible.

A paper on the Development of the Armadillo's Tooth was read by Mr E. Ray Lankester. Its chief interest lay in the determination of the presence of an enamel organ in the fœtal armadillo, although in this, as in other members of the edentata, there is no enamel in the tooth of the adult; and the enamel organ precedes in appearance the organ which forms the ivory of the tooth.

Department of Zoology and Botany.—A paper on the Mollusca of the Mediterranean was read by Mr. J. Gwyn Jeffreys.

A paper on a New Insect belonging to the tribe Ephemeridæ, and on some points in the natural history of that family, was read by Mr. R. McLachlan, who said the family of insects known as Ephemeridæ, or May flies, was tolerably familiar to all who took any interest in natural history or piscatorial pursuits. There was a certain amount of romance with which these creatures were invested on account of the shortness of their existence. Though this point was probably rather exaggerated by writers on popular natural history, no doubt some species only existed as perfect insects for about two days. Others had been proved to live for three weeks. It was also remarkable that a final moult was performed after the winged state was assumed. The insects had no great amount of beauty, and the perfect form was of a low type of organisation.

Professor Williamson followed with a paper on Tree-Fern Stems from the Coal Measures.

Department of Anthropology.—This department reassembled under the presidency of Dr. [illegible], F.R.S.

[illegible], F.R.G.S., read a paper on [illegible] Psychology. He said that the comparative psychology of the typical races of man presented a subject for investigation of great interest to every ethnological inquirer, and to all physiological anthropologists.

On Comparative Chronology and Philology Mr Hyde Clarke laid before the section the results of his later philological researches applied to America, and the question of its population. From the result of observation he proposed the first basis of a comparative chronology of the migrations of men in the prehistoric epochs between the old and new worlds. This resolved the question whether the culture of America is indigenous and aboriginal, for the languages, grammar, mythology, and culture were common to the whole human race.

Economic Science and Statistics.—This section was presided over by the Right Hon. W. E. Forster, M.P.

Professor Leone Levi read a report on the Metric System, in which he stated that the hopes once entertained of an early attainment of one uniform system of weights, measures, and coins, had been somewhat disappointed by the action of adverse political events, and the tardy concurrence of Her Majesty's Government.

Major-General Sir James Alexander, C.B., read a paper on the Use and Abuse of Peat.

Mechanical Section.—Mr Wm. Firth, of Leeds, read a paper on the Introduction of Working Coal-cutting Machinery in Mines.

Dr C. Le Neve Foster read a paper on "The Duty of Arrastres in Reducing Gold Ore in Italy." The author gave the result of experiments carried on for three years and a half in treating gold quartz containing eight to twelve dwts. per ton, in the Italian Alps, by means of the Mexican arrastres or stone mills. He said that the machines extracted 82 per cent. of the gold contained in the ore in one operation. The machines are modified Mexican arrastres, on a plan invented by Messrs. T. and J. Roberts and Henry Hoskings.

September 23

Mathematical and Physical Science.—There was a good attendance in this section, which ebbed and flowed as the matters under consideration attracted less or more attention. Mr Janssen's paper, in French, "On the Application of Photography to Show the Passage of Venus across the Sun's Disc," was important in its bearing on the transit of that planet next year, and was a good summary of what had been done in this direction. Mr. J. Norman Lockyer's two papers "On the Diffraction Grating" and "On the Results of some recent Solar Investigations," were read one after the other. The latter he was unfortunately compelled very much to cut down, but a good deal of interest was displayed, as he stated his belief that he had discovered a means of estimating quantitatively as well as qualitatively the composition of the sun's atmosphere. Sir Walter Elliot created some amusement by his proposal for the creation of a Minister of Science; most persons present, except himself, being seemingly inclined to treat the suggestion jocosely. The papers in this Section were not taken in the order in which they stood in the programme, a course which, however, it is to be accounted for, almost always tends to diminish the interest taken in the proceedings. Mr. Barrett's two papers, "On the Molecular Changes that accompany the Magnetising of Iron, Cobalt, and Nickel," and "On the Relationship of these Magnetic Metals" concluded the work of the day, considerable attention being excited, as he showed how the action of light may be availed of through its magnetic action to effect mechanical work, and how even here the law of the conservation of energy holds good, some alteration being most probably made in the motion of the pendulum when, by its receiving the flash of light at one point in its swing, the conversion of energy is effected.

Geological Section.—Dr. Carpenter's paper "On the Physical Geography of the Caspian Sea in its relation to Geological Inquiry" had to be cut short, to allow of the writer taking the prominent part he did in the Geographical Section. There was a brisk discussion on the paper on the Sub-Wealden Exploration, and that of Mr. Topley "On the Correspondence between some Areas of apparent Upheaval of the Thickening of Subadjacent Beds;" while a discussion of an hour's duration, in the course of which Mr. Woodward and Mr. Gwyn Jeffreys took part, followed Professor Phillips' two papers, but no very satisfactory conclusions were arrived at. Dr Carpenter's paper "On the Physical Geography of the Caspian Sea", presented some curious and interesting information. A great inland sea, eighty feet below the Black Sea, with no known outlet, or at most one which leads no one knows where, fed by great rivers, and presenting large salt pans: yet whose saline character is diminishing year by year. The Caspian has for long presented several features of interest, not to say mystery, which lost none of their force at the hands of the lecturer. Commander Davis's paper on the scientific voyage of the *Challenger* drew, as might have been expected, a large audience, who listened with great attention to the writer's account of the soundings taken at various points of the course travelled by the ship, and to the general account of the results of the expedition. Dr. Carpenter was again interesting in the discussion that followed, chiefly on the temperature of the deep sea, and on the modes of protecting thermometers at great depths. The old notions of a uniform temperature at great depths had long since disappeared, and it was still a marvel how, with a temperature of 29½ deg., that at many points the whole ocean did not there become converted into a vast bed of ice. Among other curious things, Dr. Carpenter stated his opinion that when the Pacific comes to be explored, it will be found to have a temperature higher than that of any known sea, since there is the smallest channel at Behring's Straits through which the cold water from the Arctic Ocean can find ingress into it, and the water from the Antarctic Ocean, which alone supplies it with cold contents, must become sensibly warmed in its passage through the heated equatorial regions. Mr. G. H. Darwin's "Account of a Portable Globe and of some Maps of the World" was interesting as an ingenious exhibition of a teaching apparatus which could be folded up when it was desired to convey it from place to place, though it was objected to because the angles formed where the triangular separate parts of it came together implied the impossibility of carrying lines along it, and so seriously affected its teaching power.

Biological Section.—In this department some interesting papers were read. In the discussion that followed the paper by Drs. Dewar and MacKendrick, "On the Action of Light on the Retina and other Tissues," Dr Harley gave an account of the effects he experienced after nine months' confinement in darkness on the account of an affection of the eyes. He became able to see and read when persons admitted to visit him utterly failed to do either, and when on a dark night he opened his shutters the bars of the window appeared to him bright and luminous. Dr. Binz's paper "On the Action of Alcohol," raised a discussion in which Dr. Brunton said he thought the action of alcohol was a progressive paralysis in which the respiratory centres became last affected. The latter gentleman also read a paper on "Cholera," detailing some experiments he had made in search of a remedy, which had not, however, yet attained such results as he hoped still to reach.

Mechanical Science.—The paper of Mr. Eaton "On the Working of Locomotives by Heated Air and Steam," gave an account of some experiments made on the Lancashire and Yorkshire Railway of working locomotives

on the new method, from which it appeared a great saving of fuel had been effected, an engine to which the apparatus had been attached consuming only fifty-eight tons of coal, as compared with another not provided with the apparatus which consumed seventy-four tons in doing the same amount of work. The remarks of Professor Reynolds went to show that this effect was gained almost entirely by the prevention of condensation of the steam against the interior of the cylinder by the formation of a film of air inside. An interesting discussion on steam tramways followed Mr. Barlow's paper on this subject, the President of the Section and others taking part in it.

The work in Section B was not above average interest, and was brought to a termination by the reading of Mr. Jessie Louth's paper "On Gas Burners."

The papers for September 23, in the Mathematical and Physical, Chemical, Geological, and Mechanical Sections, including the above-named, comprised:—

James Glaisher, report of Committee on Luminous Meteors; Sir Walter Elliot, report of Committee on Organisation of Science; Professor Everett, report of Committee on Units; Professor Everett, on a Diffraction Spectrum without a Prism; M. Janssen, on the Application of Photography to Show the Passage of Venus across the Sun's Disc; Professor A. Schafarik, on the Visibility of the Dark Side of the Planet Venus; J. Norman Lockyer, Remarks on the Draper-Rutherford Diffraction Grating; J. Norman Lockyer, Results of some Recent Solar Investigations; Rogers Field, on a new Aneroid Barometer; G. W. Hope, on Eckhold's Omnimeter, a new Surveying Instrument; W. F. Barrett, on the Molecular Changes that Accompany the Magnetisation of Iron, Nickel and Cobalt; W. F. Barrett, on the Relationship of Magnetic Metals, Iron, Nickel, and Cobalt; Dr Gladstone, to exhibit Photographs of Fluorescent Substances; C. Meldrum, on a Periodicity of Cyclones and Rainfall in Connection with the Sunspot Periodicity; Arturo de Marcoartu, on the Application of Telegraphy to Navigation and Meteorology; Arthur Schuster, on a Curious Phenomenon observed on the top of Snowdon; W. M. Whipple, on the Passage of Squalls across the British Isles; W. S. Davis, on Refraction of Liquid Waves; J. Park Harrison, Lunar Influence on Clouds and Rain; John Neville, on the Axis of Least Moments in a Rectangular Beam; W. Chandler Roberts, F.C.S., on Horn Silver; Dr. A. Schafarik, on the Constitution of some Silicates; Professor Crum-Brown, F.R.S.E., on the Action of Sulphide of Methyl on Bromacetic Acid; Charles Horner, on the Spectra of certain Boric and Phosphoric Acid Blowpipe Beads; Alfred H. Allen, F.C.S., on the Detection of the Adulteration of Tea; Alfred H. Allen, F.C.S., on the Action of Sulphuric Acid on Ethylaniline and Dimethylaniline; Alfred H. Allen, F.C.S., Note on Cresol Derivatives; Dr. H. E. Armstrong, on Alpha and Beta-Naphthylic Sulphide.

Section C.—Geology.—W. Carpenter, M.D., F.R.S., on the Physical Geography of the Caspian Sea in its Relation to Geological Inquiry; W. Willett and W. Topley, F.G.S., report on the Sub-Wealden Exploration; W. Topley, F.G.S., on the Correspondence between Some Areas of Upheaval and the Thickening of Subjacent Beds; Dr. Bryce, F.G.S., report on Earthquakes in Scotland; Professor J. Phillips, D.C.L., F.R.S., on the Ammonitic Spiral in Reference to the Question of Flotation; on the Ammonitic Suture in Relation to Geological Time; A. Champernowne, on the Discovery of a Species of Starfish in the Devonian Rocks of South Devon; J. Thomson, F.G.S., on the relation of *Zaphrentis giganteum*, *Z. cylindricum* and *Z. Bowerbankii* to the Genus *Cyathophyllum*; Baron Von Richthofen, the Loess and Salt Basins in Northern China; W. Whitaker, B.A., F.G.S., note on the discovery of Thanet Sand on the Northern Outcrop of the London Basin, near Sudbury; Professor Tennant, note on Diamonds.

Section G.—Mechanical Science.—Report of Committee on Treatment and Utilisation of Sewage; Report of Committee on Babbage's Analytical Engine; Report of Committee on Waves and Roughness of Sea near the Shore; W. H. Barlow, jun., on the Lisbon Steam Tramways; W. Cave Thomas, on the Centre-rail Railway; Archibald Veill, on Stone and Wood Dressing Machinery; C. Burgeron, on the St. Gothard Tunnel; John White, on the Form of Channel Steamer; P. le Neve Foster, jun., on the Irrigation of the Casale District; R. Eaton, Further Results on the Working of Locomotives with Heated Air and Steam; Hyde Clarke, on the Direct Railway to India; John Waugh, on the Prevention of Incrustation in Steam Boilers.

SEPTEMBER 24.

SECTION A.—Mathematical and Physical Science.—Dr. J. H. Gladstone, Exhibition of Photographs of Fluorescent Substances; C. Meldrum, on a Periodicity of Cyclones and Rainfall, in Connection with the Sunspot Periodicity; Rogers Field, on a new Aneroid Barometer; G. W. Hope, on Eckhold's Omnimeter, a new Surveying Instrument; Arturo de Marcoartu, on the Application of Telegraphy to Navigation and Meteorology; J. Traill Taylor, note on Leon Vidal's Photo-Polychromy; G. M. Whipple, on the Passage of Squalls across the British Isles; John Neville, on the Axis of Least Moments in a Rectangular Beam; W. S. Davis, on Refraction of Liquid Waves; J. Park Harrison, Lunar Influence on Clouds and Rain; Arthur Schuster, on a Curious Phenomenon Observed on the Top of Snowdon; W. Marsham Adams, to Exhibit the Mensurator, an Instrument for Solving Triangles, Quadratic, and Simple Binomial Equations.

SECTION C.—Geology.—Dr. Bryce, F.G.S., Report on Earthquakes in Scotland; Professor J. Tennant, F.G.S., notes on Diamonds in South Africa; Baron Von Richthofen, the Loess and Salt Basins in Northern China; W. Whittaker, B.A., F.G.S., note on the Occurrence of Thanet Sand and Crag in the North West Corner of Suffolk (Sudbury); J. W. Ellis, note on Stump Cross Caverns, at Greenhow, near Pateley Bridge.

CONCLUDING GENERAL MEETING. This was held in the Mechanics' Institute in the afternoon, and was largely attended, especially by the ladies. Not much science was talked, however, the prevailing sentiment being the distribution of "soft soap," which, it must be acknowledged, was dispensed with lavish impartiality on all, from the hard-working president to the harder worked Press. The programme commenced with the reading by Captain Douglas Galton of the synopsis of grants of money appropriated to scientific purposes by the General Committee. These sums varied in amount from £20 to £150, and made in the aggregate £1,495. The highest amount granted was for the Kent's Cavern Exploration, and the announcement when made was received with applause. Two other grants are worthy of note as being of local interest, viz., that for the exploration of the Victoria Cave at Settle, and the grant for dredging off the coast of Yorkshire. Another item of £50, not included in the above, was voted to the widow of Mr. Askham, who for many years was a faithful and valuable servant in the capacity of clerk to the Association. Contrary to the expectations which, up to the end of last week, were warranted by the circumstances, it would seem from the statement read by Captain Galton that the number of members and associates had received a large acquisition during the last few days, the total number of those who had enrolled their names up to one o'clock being 1,983, and the receipts £2,102. After the reading of these figures, the long list of "votes of thanks" was begun. Amidst a great deal of what was no doubt mere compliment, we think enough may be gleaned to justify the people of Bradford in coming to the conclusion that on the whole the visitors to that town have been satisfied with the reception they have met with in our busy manufacturing community, and that the accommodation provided for the numerous meeting was considered ample. Mr. Ripley's remarks, in moving a vote of thanks to the President, expressed a sentiment which, says the *Bradford Observer*, we are sure will be shared by all those who have come in contact with the members. He hoped that the associations formed during the visit would prove mutually beneficial to the visitors and to the visited. We think, says the same journal, we can answer that a great many of the inhabitants of Bradford will have pleasant recollections, as well as useful ones, of the visit of the British Association, and we trust that those who have come to the town from a distance will go away with similiar feelings towards its inhabitants.

[*.* We are indebted to the Bradford journal above mentioned for much of the information presented in our notices of this meeting of the British Association.]

PATENT LAW REFORM.

H. E. H., a member of the Inventors' Institute, has sent us a very interesting letter on the above subject. As, however, it is very long, and most of his suggestions are similar to those which have already been well ventilated in the SCIENTIFIC AND LITERARY REVIEW, we give only the following:—

"With regard to fees to pay to the Government for patents, I think that 10s. would be quite enough for the first twelve months, and £2 for the second year; and so on, up to the fourteenth year. I think that a difference ought to be made after the first year's fee has been paid between a frivolous invention (toys, &c.) and a valuable invention, a steam engine, for instance. To pay the same fee for a patent on a small toy as for a patent on a marine steam engine is a very unfair charge. If a patentee pays 10s. for the first year, we must add to the above sum the fee of the patent agent, making a total of £2 or more to be paid for the first year. I have no doubt that the authorities and others will question the soundness of the patent charges being made so cheap, as some critics would say that the country would be overstocked with patents, and manufacturers would be seriously injured by the same system; and others might say that in the course of time inventors could not find machines to improve upon, as all would be quite perfection. In answer to this, I must refer these critics to the steam engine and the great number of improvements in the above; also to the numerous improvements that have been, and will be, made in various other motive powers. Electricity and the telegraph, also electro-magnetism—all of these inventions will have numerous improvements made in them in the future; and I could name many other inventions out of countless subjects that could be improved upon. The public will never be tired of buying inventions of each class in great variety, as most people like to have a great number of new patents to choose from."

MESQUITE gum is the name under which a substance obtained from the *Prosopis glandulosa* is known in Texas. Attention has lately been directed to this gum from the fact that it seems to be identical with gum Arabic, and consequently admits of application to many medicinal and technical purposes.

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ESTABLISHED 1st MAY 1862

Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D, F.R.S, &c, from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868 LORD RICHARD GROSVENOR, M P

Chairman of the Council

SIR ANTONIO BRADY

NOTICES.—SESSION 1873 4.

The first members' meeting will be held on Thursday, November 13th, when the opening address will be delivered 8 o'clock p m

THURSDAY, NOVEMBER 13TH — A paper will be read by E R. Southby, Esq, on "The Economic Use of Gas for Heating and Cooking Purposes," to be followed by discussion 8 o'clock p m

Council meetings to take place at 7 p m on each of these evenings.

TO MEMBERS OF COUNCIL.

Subscriptions are payable to Mr G A SHRIETON, the Receiver, 4, St. Martin's-place, S W, who is the proper official to give receipts.

F W CAMPIN, Sec

Proceedings of the Institute.

A meeting of the Council (ordinary) of the Inventors' Institute was held on the 16th of October, 1873, at the Offices of the SCIENTIFIC AND LITERARY REVIEW, 21, Cockspur-street. Mr C G. Carttar, Member of Council, presiding

After the minutes of the last meeting had been read and confirmed as being correctly entered,

Mr. F. W. Campin, the Secretary, reported that, in accordance with the resolutions passed at two previous meetings of the Council, he had communicated with S. C. Lister, Esq., J Holden, Esq., and others, with regard to the representation of the Institute at the Bradford meeting of the British Association, and that S. C. Lister, Esq., had kindly consented to act as representative of the Institute thereat; and he had also very handsomely offered to entertain the Chairman of the ordinary Council and the Secretary if they visited Bradford on that occasion, in accordance with the Council's request. The Secretary also stated that although Mr. Webster, Q.C., had read a paper on the Patent Laws at one of the sectional meetings of the Association, no discussion was reported, but a special meeting was held at which Mr Lister presided (see report in another column). With regard to the Social Science Congress at Norwich, Mr. Evans, C.E., kindly consented to act as representative of the Institute. He likewise stated that it was his melancholy duty to announce the death of Mr. Cornelius Varley, an old and much-respected member of the Institute, well-known as an artist and a man of science, who was the father of Mr. F. H. Varley, C.E., Chairman of the ordinary Council or Executive of the Institute, and Mr. Cromwell F. Varley, the eminent electrician.

After some remarks by the Chairman, eulogising Mr. Varley, and thanking Mr. Lister, it was resolved unanimously—

"That the condolence of this Council be, and is hereby, offered to Mr. F. H. Varley, Chairman of the ordinary Council or Executive of the Institute, and to the other members of the family of the late Mr. Cornelius Varley on his lamented decease, and this Council hereby record their high appreciation of his sterling character as a man, and eminent talent as an inventor and practical man of science, and that a copy of this resolution be remitted to Mr. F. H. Varley"

It was also resolved unanimously

"That the thanks of this Council are due and are hereby tendered to C. S. Lister, Esq., for his services in representing the Institute at the last meeting of the British Association held at Bradford, and that a copy of this resolution be transmitted to Mr. Lister by the Secretary"

"That the thanks of this Council are due, and are hereby tendered to D. Evans, Esq, C E, of the Gas Works, at Norwich, for undertaking to represent the Institute at the Social Science Congress."

"That the Chairman of the Council Sir A. Brady, or Mr. Hume Williams, the Vice-Chairman of the Council, according as it may be convenient to those gentlemen, be requested to deliver an opening address in the commencement of the ensuing session"

"Also, that the first meeting be held on Thursday the 20th November."

The various gentlemen who had proposed to read papers before the Institute were ordered to be communicated with and the prospectus of the Society for the Promotion of Scientific Industry at Manchester was considered when it was resolved unanimously

"That this Council solicits a Conference with some one appointed by that Society with the view to ascertain what co-operation could be brought about"

Mr. Carttar specially proposed for election Mr Marshall Adam.

The usual financial communications from the Treasury Committee were made to the Council, and the following gentlemen admitted as, were ordered to be placed on the list of, members viz, Mr. Edward Lord, as life member and Messrs Edward Lord, H Handyside, J Nettleford H Hand Coombe F R Sharp, F S S Darby, J Hill Dr D Mackay

Monthly Notices.

Deaths of Mr. Cornelius Varley and Sir E Landseer.—Prominent amongst the events of the month are the deaths of these two men of eminence in the artistic world the fame of the latter being almost universal, and that of the former very great amongst all who take an interest in scientific progress He was a member and warm supporter of the Inventors' Institute We reserve a memoir of him for another page

Turners' Company and Technical Education The prizes of this Company for turnery work were distributed by the Lord Mayor, on the 13th October, at the Mansion House

Discovery of a Planet—Dr Luther, Director of the Bilk Observatory near Dusseldorf, discovered another small planet on the night of the 27th of September "This," says the *Athenæum* "is the first discovery of the kind made this year in Europe, and will probably be reckoned as No 131 of the list, as nothing further has been heard of the planet seen once only by Dr Peters on July 29

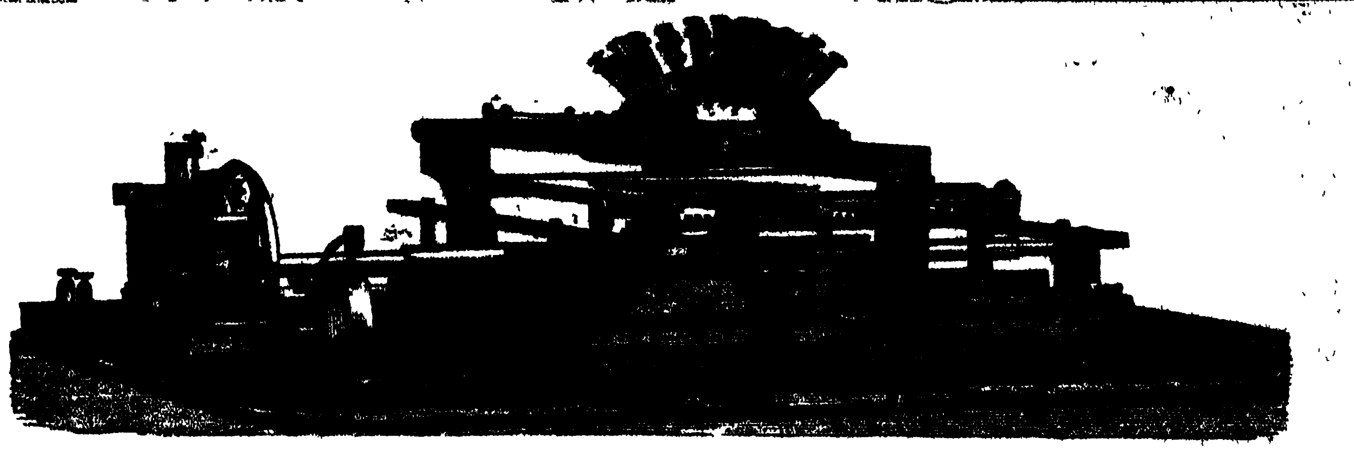
Les Mondes chronicles the death of M Jean Chacornac, an astronomer of celebrity, born on the 21st of June, 1823, near Lyons, where he died He was at one time attached to the Paris Observatory, and was the discoverer of six of the large group of Minor Planets, between the years 1853 and 1860

Sand-blast Process—At the meeting of the Microscopical Society, on October 1, Mr F H Wenham made some remarks on the microscopical appearance of glass which had passed through the American sand-blast process, showing that the erosion of the surface was entirely due to the percussive force of the particles of sand, and that the results of this were demonstrated by the polariscope A number of specimens were exhibited in the room

Prof Reilly, the Professor of Engineering at the Indian Civil Engineers' College, Cooper's Hill, has in the press a treatise on his branch of science

Detection of Sewage in Water—A simple means for this is given in the *Journal* of the Franklin Institute A half pint of the water should be placed in a perfectly clean colourless glass bottle; a few grains of the best white sugar should be added to it, and freely exposed to daylight in the window of a warm room. If the water becomes turbid, sewage contamination may be suspected.

Lightning and Lightning Rods—In the above-mentioned *Journal* for September, Mr. J. M Mott ends his papers, stating the following as amongst his other *conclusions*.—"Lightning-rods as usually erected do not afford much protection." "The conducting power of lightning-rods is proportional to their solid contents, and not to their surfaces" "Insulators are of no use in any case." "The rod must be attached directly to the building, the closer the better" "Sharp points for the upper termination of rods are necessary; rods are of but little value without them."



THE WRITING BALL, OR ELECTRIC TYPE-WRITING APPARATUS.

This invention was patented in this country as far back as May, 1870. In October of the same year Professor C. Hotten, the successor of the celebrated Hans Christian Ersted, as Professor of Natural Sciences at the Copenhagen University and Director of the Polytechnic College of that city, gave a description of it in the *Copenhagen Illustrated Paper*, after which it was introduced to a larger public in an article in the Leipzig periodical, *Annalen der Typographie*.

Although this apparatus is termed a writing ball, it is not because it is a ball *simpliciter*, but because the ball part of the apparatus is in reality the pith of the invention. To attain the rapidity aimed at, the letters must be impressed or made visible in some way on the paper by as simple a motion of the hand or finger as possible, the simple depression of a type placed under the immediate and ready control of the end of the finger against the paper will do this. In the ball part of the writing ball there are therefore a certain number of pistons, placed as radii to the ball, carrying type on the lower end converging to a one common centre; on the upper end, convenient knobs for depressing them. These pistons, depressed or struck down against a paper placed in the plane of the common centre would thus make their mark one after the other in the same spot, and to attain a legible production we therefore want an inking process and a forward motion of the paper. The former is obtained through the use of carbon or manifold paper, which by preference is only coloured on one side, so as not to cause the type to get unnecessarily clogged, the latter is accomplished in the following manner:—The paper is placed and fixed on a flat slate or table, the surface of which lies in the plane of the common centre for the above described type-carrying pistons, this table rests on four wheels on to two rails supported by a movable framework, and to provide for the double motion of this slate or table it is fitted on its lower side with a rack gearing into a spur wheel, mounted on a spindle on which it moves longitudinally (held in its position transversely by means of a pin moving in a groove in the spindle), the spindle being rotarily moved by means of a clock-spring actuated by a toothwheel at each depression of one of the type-carrying pistons is arrested by an escapement in connection with the armature of an electro-magnet, and released as soon as the finger releases the piston, thus allowing the slate on which the paper is fixed to remain stationary while it receives the impression of the type; and moving it a step (the distance necessary between each two letters) forward ready to receive the impression of the next letter; proceeding towards the end of the line in this manner, when the slate is pushed back to its original position. But on its lower side is likewise fitted a steel tooth gearing into a fixed ruchet pole, which in its returning motion it grips, and is thus at once moved the same distance forward longitudinally on the spindle as the teeth on this ruchet are apart, or in other words, on to the starting point for the next line. The electrical connection between the pistons in the ball part and the escapement above referred to is accomplished in the following manner:—The ball, or half sphere, has a semi-spherical cover, which rests on the ball by insulating pieces of ebonite; springs or contact pieces are attached to this cover, so as to establish connection with one pole of the electric battery when one of the pistons is depressed, the other pole being in connection with the solid casting forming the lower part of the ball in which the concentric pistons are moving. To provide the spacing between the words, or between each two letters to emphasise any word, one of the pistons is cut shorter at the lower end than the rest, to prevent its touching the paper, the depression of this therefore causing the same forward motion of the paper as any of the other pistons, but leaving no impression on the paper. A bell shown is used which serves to indicate to the writer when the line is completed; it is struck by means of a small hammer, actuated by a pin on the escapement wheel, and can be set to strike at any point of the complete line, thus enabling the writer to have the indication at the proper time for whatever size of paper he may be using.

The whole construction of the apparatus is simple and to the purpose, the spherical form of the ball part corresponding well with the natural position of the hands. It can be worked very quickly, the rate of speed of course depending in a great measure on the operator. The usual speed obtained is ten letters per second, which is about three times as quick as ordinary writing.

Through the use of manifold paper for the inking process, several copies may be taken at one operation. We have seen as many as ten copies taken in this way.

Apart from the ordinary uses to which the writing ball may be put, as already noticed, there are many others of rarer but of no less important a character. For instance, a person deprived by nature or accident of his hands and arms could still write his own letters with clearness and despatch. By a very simple arrangement a small hammer could be affixed to the stumps, and the pistons of the ball be struck down with this hammer instead of the fingers.

Again, we all know how difficult a matter it is to teach the blind to write, and that even after this has been accomplished a greater difficulty remains, for it is impossible for the blind writer to read what he has written. By the use of the writing ball, however, this difficulty is obviated. On the lower end of the pistons, instead of the ordinary Roman letters, are, for this purpose, engraved those characters which have been found by experience to present an outline best calculated to be read by means of the touch of the fingers.

Upon the movable writing slate or table above referred to is placed a bed or pad of some soft material—blotting paper will answer the purpose. On this pad the writing paper is placed, and the instrument manipulated in the same manner as described for ordinary writing, when, instead of letters in colour, the blind alphabet in relief will be produced.

It will also be evident that the writing ball is remarkably suitable for the use of secret or Eastern alphabets, as the ordinary letters can be engraved on the top knobs, while the type are engraved with the corresponding letter in the secret alphabet, or in any alphabet not known to the operator.

THE PATENT LAWS.

MEETING IN BRADFORD.

On the 24th ult., a meeting of gentlemen interested in promoting certain reforms in the law respecting patents, took place in the rooms of the Bradford Chamber of Commerce. Mr. S. C. Lister was called to the chair.

Mr. Thomas Webster, Q.C., in opening the meeting, explained that during the recent Exhibition at Vienna an international conference had been held with a view to the consideration of the English and foreign patent laws. The circumstances which led to it were that the Americans suggested that the question should be taken up, and the conference was formed of distinguished persons representing all countries. They were assembled on one occasion to the number of 150, and voted in numbers of 70, 80, and 90. A general wish was expressed that the rights of inventors should be protected, and many of them were in favour of an international patent system. When the matter came to be discussed it was thought desirable that the various systems should be assimilated as soon as possible, leaving the administration of them to different nationalities themselves. He proceeded to detail at considerable length the difference between the English and American patent systems, pointing out certain objections to the latter, and said that the principles of the two countries were identical and the practice very much less different than at first sight appeared. He stated that by the Act of 1852 the Caveat system in this country was abolished. That was a system which gave a period of probation and trial during the perfecting of the invention. The provisional specification now in operation had the same object as the Caveat system, which was still in operation in America. The next difference was that they had in America a system of re-issue which was practically the same as our amendment and alteration. He should recommend that the English system should be adopted. Another difference was in the examination system. In America they had a system of examination which was more or less defective, and the result was that, instead of only one-half, about one-fifth of the patents were refused. The remaining difference was the [illegible] payment system. In England patents were granted for a period of from seven to four-

teen years, subject to a payment of £50 at the end of the third year, and £100 at the end of the seventh year. From this revenue there was a surplus of about £80,000 per year, and it would be for them to consider what proportion of that ought to be applied to industrial purposes and museums in different localities, whereby they might have the industries or trade of a town shown in a museum for the education of the people, or otherwise the inventors ought not to be charged the sums that they were. The speaker pointed out that after patents had been entered, about one-third died from natural causes, or were abandoned for want of novelty or utility, and if a system of examination was established he believed they would not have more than one-fourth of the patents granted. At Vienna there was considerable unanimity on the subject of compulsory licenses, and a resolution was carried in favour of compulsory licenses, but this was fenced round with the condition that if public interest should require it, the inventor should allow the use of his invention to suitable applicants upon adequate compensation being made. The last resolution passed at Vienna was that the members of the different nationalities should form sub-committees in their various countries, with power to add to their number, for the purpose of carrying out the aims of the conference.

Mr. F. J. Bramwell wished to make a few remarks on various points raised. First as to the extension of a patent beyond fourteen years, he did not know what had been proposed, but he thought it most important that there should be a power of prolonging them beyond fourteen years. He next referred to what he considered were certain anomalies in the state of the law, or the manner in which it was laid down by the authorities. There was one thing that struck him as particularly absurd. It was the practice of the Privy Council that if a foreign inventor, having got a patent in England, and at the same time had taken a patent in France, found that there was not sufficient trade in France, and suffered the patent to lapse, they would refuse him a renewal of the patent in England, when if he had not taken a patent in France they would have allowed it. It was alleged that it was unfair to put Englishmen to an expense which Frenchmen would not have to pay.

Mr. Webster said the Privy Council had felt ashamed of themselves.

Mr. Bramwell also thought it desirable to have the provisional specification on the payment of £5, which would allow a person six months to determine whether he would go on with his patent, and whether it was likely to be useful. He next referred to a decision of the Lord Chancellor, three or four years ago, that if two men had got a similar invention, and the second man obtained the seals to his patent before the first, notwithstanding that the latter had not had six months for preliminary examination, the six months plan had been found to succeed so well that one-third of the applicants proceed no further, and at the expiration of three years, as they knew, a large number of patents were allowed to drop. He thought the compulsory license question was a hard one to swallow, and he called the attention to the fact, that as the law was laid down at the present time the Government was not bound by any patent, but such inventions as were useful in the construction of ships and manufacture of arms and ordnance could be used, notwithstanding the rights of the inventor. That seemed to him to be a most improper thing to do. The Government ought to be as much compelled to pay as any private manufacturer. (Hear, hear.)

Mr. Oldham said he had suggested, in one of the sections of the British Association, that there should be an appointment of a Minister of Science, who might be paid out of the £80,000, per year derived from patents. He thought this would be a legitimate means of spending a portion of the money. (Applause.)

The Chairman, who said he attended as the representative of the Inventors' Institute, said they might have patents as cheap as they could get them, but he objected to have commissioners to see whether a patent was good or bad. He thought they should only be required to judge of the novelty of a patent, and then he knew very well they could make a mistake, as they knew how difficult a thing it was to prove whether a thing was new or old. With reference to compulsory licenses, Mr. Webster and he had had some strong battles, but he thought he (the Chairman) had been so far convinced that he thought it was a point that inventors should yield to the general feeling of their opponents, but compulsory licenses must be edged in with the greatest care. The Chairman went on to speak of the litigations which he had had on various points.

Mr. Webster said that in some foreign countries a patent was bound to be put into use in the course of eighteen months or two years.

Mr. R. S. Newall, of Gateshead, said that since he had first taken a patent—about twenty-five years ago—he had taken a great interest in the Patent Law. He pointed out that if compulsory licenses were granted, the patent right would not be absolute in the inventor. He proceeded to read a sketch of a proposed new patent bill which he compiled in 1848. His suggestions were that a patent should be granted for a term of five years subject to a payment of £50, the term to be extended up to twenty years by five years at a time, and a payment of £50 at each period.

Mr. Webster said that personally he knew that the Act of 1852 had endeavoured to deal with the grievances contained in Mr. Newall's pamphlet. After some further discussion,

Mr. Young, of Glasgow, moved that the president of the Bradford Chamber of Commerce be requested to convene a meeting to consider the proper proportions of the surplus received from the money to be paid to the commissioners used for the purpose of establishing industrial museums, and to appoint a committee for that purpose.

Mr. J. R. Napier, of Glasgow, seconded the resolution, which was carried.

Mr. R. S. Newall next moved that the president of the Bradford Chamber of Commerce be requested to call a meeting to discuss the recommendations of the committees of the House of Commons of 1871 and 1872 on the Patent Laws, and report to the London Committee of the Vienna Congress.

Mr. Oldham seconded the motion, and on it being carried, the meeting separated.

ZOOLOGICAL SOCIETY OF LONDON.

The first scientific meeting of this society for the session 1873-74 will take place at the society's house, No. 11, Hanover-square, W., on Tuesday, the 4th of November at half-past eight o'clock, p.m., when the following communications will be made:—1. The Secretary—Report on the additions to the society's menagerie. 2. Mr. J. Beswick Perrin—On the myology of the *Opisthocomus cristatus*. (Received 17th June, 1873.) 3. Mr. Montagu R. Butler—Description of several new species of Diurnal Lepidoptera. Communicated by Mr. A. G. Butler. (Received 1st July, 1873.)

The following communications also have been received:—1. Mr. Robert Swinhoe, H.B.M. Consul, Chefoo—On the Song Jay of Northern China, with further notes on Chinese ornithology. (Received 28th July, 1873.) 2. Mr. R. B. N. Walker, C.M.Z.S.—Letter from, respecting endeavours to send a living Gorilla to the Society. (Received 30th July, 1873.) 3. Mr. Sclater—Characters of new species of Birds discovered in New Guinea by Sig. D'Albertis. (Received 1st August, 1873.) 4. Mr. J. V. Barboza du Bocage, F.M.Z.S.—Observations sur le Bucorax del Afrique australe, *Bucorvus caruncculatus cafer* *Schleg*. Received 4th August, 1873.) 5. Surgeon-Major Francis Day, F.Z.S.—On some new or little known Fishes of India (Received 5th August, 1873.) 6. Capt. R. Beavan, Bengal Staff Corps, C.M.Z.S.—List of fish collected from the river Nerbudda, Nunar District, Central Provinces, India, March and April, 1873. (Received 19th August, 1873.) 7. Capt. R. Beavan—Notes on some facts bearing upon the Darwinian theories (Received 19th August, 1873.) 8. Mr. J. V. Barboza du Bocage, F.M.Z.S.—Note sur l'habitat de l'*Euprepes cortes* (Received 3rd September, 1873.) 9. Mr. R. Bowdler Sharpe, F.Z.S.—On a collection of birds from Mombar in Eastern Africa (Received 9th September, 1873.) 10. Mr. R. Bowdler Sharpe, F.Z.S.—On a collection of birds from the river Congo. (Received 9th September, 1873.) 11. Mr. G. B. Sowerby, Jun.—Description of eleven new species of Shells. (Received 15th September, 1873.) 12. Dr. J. E. Gray, F.R.S.—On the skulls and alveolar surfaces of Land Tortoises—*Testudinata*. (Received 15th September, 1873.) 13. Dr. Edward L. Moss, F.R.C.S.I.—Description of a Vergularian Actinozoon from Barraud's Inlet, British Columbia (Received 25th September, 1873.) 14. Dr. O. Finsch, C.M.Z.S.—On *Lamprolia Victoriae*, A most remarkable new Passerine bird from the Feejee Islands. (Received 25th September, 1873.) 15. Mr. W. S. Atkinson, M.A.—Descriptions of two new species of Butterflies from the Andaman Islands (Received 29th September, 1873.) 16. Dr. T. Spencer Cobbold—Notes on Entozoa, Part 1. (Received 8th October, 1873.) 17. Mr. Edwin Ward, F.Z.S.—Description of a new Bird of Paradise of the genus *Epimachus*. (Received 13th October, 1873.) 18. Surgeon-Major Francis Day, F.Z.S.—On Dr. Buchanan's Fishes of Bengal. (Received 14th October, 1873.) 19. Dr. James Hector, C.M.Z.S.—On *Cnemiornis calcitrans*, showing its affinity to the Natatores. (Received 16th October, 1873.)

BRAY'S TRAM CLEANER.

This apparatus is adapted to be fitted to tram cars, and by its adoption, as the cars progress, the trams or rails of tramways may be cleaned or cleared of snow, ice, dust, or other objectionable accretions of matter. One end of a lever is secured to a bar extended and secured from one axle-box to the other, or to one axle-box only, so by this arrangement the cleaner, or clearer, may be kept working at the same distance from the tram as the centre of the wheel maintains; and the other end of this lever is provided with an instrument similar to a plough, which may terminate in a steel tool or cutter, or in some cases may have steel brushes attached thereto to brush off dust from the tram or rail, such plough, &c., working close to the periphery of a car wheel. A spring, secured to the lever, acts between it and the under part of the carriage. The above-mentioned arrangement will be applicable to a single wheel; but if it be desired to render the apparatus useful for either one wheel or the other, the upper end of the lever and of the spring are secured to a block, bolted to the bar, free to turn; so that the whole apparatus can be turned round from the periphery of one wheel to that of the other. To regulate the working of the apparatus, a guide bar is used, which is secured to the under side of the carriage. By means of a foot lever arrangement, the clearer can be raised from the tram or rail when desired. Or instead of the foot lever arrangements a system of chains or pulleys may be used for effecting the same object.

Reviews.

Rays of Light. A Pamphlet. By F. Ayckbourn. Printed and Published by Joseph Bruton, at 12, Crane-court, Fleet-street, E.C.

This is a very interesting little work, selling for one penny, containing some very sensible remarks on matters connected with inventors and inventions. Perhaps the following, which refers to a department of invention often made a *cheval de battaile* by the Anti-Patent Law party, is as good as anything in the book:—

LITTLE INVENTIONS.

It is, perhaps, difficult to select an article of less pretension to head our list of "Little Inventions" than the old tinder-box, for which, by-the-bye, we never heard that any of our ancestors claimed any special credit as inventor and patentee, or that its prime discoverer was ever heard of. It consisted of a round tin box about the size of a muffin, with a tin lid dropped loosely inside. Some burnt rag or tinder was placed in the box, and the operation of lighting was effected by means of a clumsy piece of steel held in one hand over the tinder, whilst the other hand held a flint stone which, on being struck forcibly against the steel, was expected to elicit a spark, and that spark, if carefully blown on the tinder, communicated sufficient heat to set light to a brimstone match. These phosphorous matches were first sold by Watts, a chemist, near Charing Cross, at a shilling the bottle, together with some thirty or forty prepared matches, which on being dipped in the bottle and withdrawn produced a light. But see what we have now in common use everywhere! Matches, which for the price of one of those bottles of Watts' we can buy enough to last an ordinary family for two years. From this little invention innumerable large factories have sprung into existence, and thousands of operatives are constantly employed both in this country and abroad, involving the wholesome circulation of an enormous capital.

The Story of the Earth and Man. By J. W. Dawson, LL.D. Hodder and Stoughton.

This is a pleasing book on the subject which is now, perhaps, more popular than others within the range of scientific speculation. The opposing theories of man's origin are strongly put, and Dr. Dawson makes out a good case against the evolutionists, and supports a theory agreeing with the teachings of the Book of Genesis. He is, in fact, anxious to consider man "as a son of God," and "not a descendant of Miocene Apes, scourged into reason and humanity by the struggle for existence in the Glacial period."

Quantitative Chemical Analysis. By T. E. Thorpe, Ph.D., F.R.S.E., Professor of Chemistry, Andersonian Institution, Glasgow. London: Longmans, Green, and Co. 1873.

The qualifications of a successful teacher of science must, amongst others, be that he imparts the correct view of the science taught, and also that he will, so to speak, popularise his subject without deteriorating from correct teaching, and thus hold the attention of the student, as otherwise it will be found that the students will not have gained the amount of knowledge which is desiderated; and this is especially true with respect to a work on science written for the use of beginners, as, if the work be dry in manner and style, and contain much mathematical technicality, very few students will be found to reap any benefit from it. On the other hand, however, if it be pleasant reading, and the author avoid so far as possible all such technicalities, it will be a work much sought after.

These we have found to be, generally speaking, the views adopted by the authors of this excellent series of works on science, of which that now under notice forms one. Dr. Thorpe is a writer who has been known for some time as an authority in chemistry, and this work will serve to enhance the reputation he has already obtained. The author states his aim to be to teach the principles of Quantitative Chemical Analysis by the aid of examples chosen partly on account of their practical utility, and partly as affording illustration of the more important quantitative separations, and we think that the aim has been well attained. The work is divided into five parts, namely:—principles of quantitative analysis, simple gravimetric analysis, simple volumetric analysis of solids and liquids, general analysis involving gravimetric and volumetric processes and organic analysis, such parts being subdivided into chapters.

To all interested in the science of chemistry we recommend this work, but especially to the student, to whom it will be found of great service.

The Darwinian Theory and the Law of the Migration of Organisms. Translated from the German of Moritz Wagner, Honorary Professor at the Ludwig Maximilian University of Munich, and Member Extraordinary of the Royal Bavarian Academy of Sciences. By James L. Laird, Assistant-conservator of Forests, Panjab. London: Edward Stanford, 6 and 7, Charing Cross, S.W., 1873.

All adherents of the Darwinian theory will find this a very interesting and instructive production. As it is a pamphlet under 70 pages in length, it is unnecessary for us to say any more about it.

A Handbook of Sewage Utilisation. By Ulick Ralph Burke, M.A., Barrister-at-Law. Second edition, revised and enlarged. London. E. and F. N. Spon, 48, Charing-cross.

This is a second edition of a very useful work, for it does just what all interested in the sewage question want done,—it places before them a succinct, and withal impartial, statement of the nature and effects, as far as can be ascertained, of the various plans of dealing with the sewage of our towns. In this new edition Mr Burke has been enabled to add a considerable amount of new matter, and to modify in some instances remarks made in reference to certain systems.

Mr. Burke treats the subject under several heads—1, Nature of the Evil; 2, Remedies; 3, Chemical Treatment; 4, Filtration; 5, Irrigation; under which head he discusses the question of noxiousness or non-noxiousness of sewage irrigation in regard to cattle food, from which we extract the following remarks:—

It must be well known to everyone who is interested in the utilization of sewage, that the ammonia contained in it constitutes its most valuable manurial quality, and we have already seen how the various systems of chemical precipitation have failed to secure the volatile substance; and it becomes a question, in considering the advantage of the irrigation system, to see how far this ammonia is liable to be wasted by the conveyance of the liquid sewage in open conduits; a mode of distribution which must of course greatly diminish the expense and increase the practicability of all irrigation operations. The experiments have been most satisfactory, and show that while in twenty-four hours the loss of ammonia is scarcely appreciable, after three days the proportional loss amounts to little over thirteen per cent. Another extremely satisfactory fact connected with this loss of ammonia is that when sewage becomes putrid the ammonia which it contains is diminished in quantity, so it becomes the interest of the farmer as well as the public to apply the sewage before it becomes offensive.

The disposal of sewage by means of irrigation is as old as it is simple and natural. As early as the year 1861 there was a sewage farm near Edinburgh, and the irrigation of the celebrated Craigentinny meadows was begun before the year 1760. The sewage of Edinburgh is still applied to these meadows with great success and profit, and those who desire a full and detailed account of the works and operations generally, will find a very interesting account by Mr. McPherson, engineer to the city of Edinburgh, quoted in the *Tottenham Report*, pp. 72-80; 3 S. U. C., p. 198; and 1 R. P. C., p. 74. There appears to be a great waste of sewage, owing to the insufficient area of the land under treatment, and many improvements might be made in the formation of the channels, yet the success of the works in a sanitary point of view is most encouraging, and the profits derived from the crops almost incredible; the crops of rye-grass fetching from £25 to £36 per acre. The lower end of the Craigentinny estate was simply sea-shore, until the sewage was applied to it; it is now as fertile as the rest of the farm, getting richer and richer every year, notwithstanding the enormous crop annually taken off it.

The two most successful sewage farms in the South of England are Norwood and Croydon, the clay land at the former place appearing to be equally successful in purifying the sewage as the light porous soil of Croydon. As to the value of differently constituted soils, see 1 R. P. C., pp. 65-70. It must always be borne in mind that the plant or vegetation has infinitely more to do with the purification of the sewage than the nature of the soil itself. As to the relative success of the works at Croydon and Norwood, see *Tott. Report*, pp. 80-90, and 1 R. P. C., pp. 85 87.

As to Barking, where a farm of about 220 acres has been laid out by the Metropolitan Sewage Reclamation Company, under Mr. Martain, see *Tott. Rep.* 90, and 1 R. P. C., 76. The land was cropped with early carrots, onions, parsnips, potatoes, and mangold, as well as rye-grass, and the agricultural result appears to have been most satisfactory, the value of the crops in some instances reaching £38 per acre. At Aldershot, again, the best cabbages that come into the London market are said to be grown on the sewage farm. [*Tott Rep.*, 93, and 1 R. P. C., 77]

But perhaps the irrigation system has been carried out with the greatest success at Croydon. The soil and "lie of the land" are most favourable for the adoption of the system, and while citing Beddington meadows as an example of the advantages of the irrigation process, it is not to be supposed that the results could be quite so favourable in every locality, though an examination of the comparative table 1 R. P. C., 94, 95, will show that in many other places the results have been nearly as satisfactory. The soil of Beddington is open, on a gravelly subsoil, with just sufficient slope to render easy the distribution of the liquid sewage over and through it, and there is just sufficient fall between the top and bottom of the farm to allow the tail-water of the upper fields to be spread a second time over the fields below before it drains finally away. The works now in the hands of the local authorities were planned by Mr. Baldwin Latham.

The results of an extensive series of experiments on the manufacture of iron, made at the Government smelting works in 1871, are recently published in the *Zeitschrift für das Berg-Hutten, und Salinen-wesen in dem Preussichen Staate*. These are well worthy the attention of all who are concerned in economizing fuel in the production of pig-iron.

Correspondence.

PHRENOLOGY.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—As the paper read by Professor Ferrier at the late meeting of the British Association, Bradford, concerning the functions of the brain, has elicited remarks derogatory to phrenology from more than one quarter, I hope, in the interest of "fair play," you will permit one interested in the cause of phrenology to publish, through your medium, a few words concerning these remarks. This favour is solicited more especially as phrenology, from its discovery to the present time, has been a subject of much interest to many minds disposed to enquiry.

It has been observed in a "leader" of the *Times*, Sept. 24th, that "twenty-five or thirty years ago phrenology was taken up by that large class of people who feel a lively interest in what they conceive to be science, but whose minds have never undergone the training necessary to enable them to understand the nature of proof, or to estimate the value of evidence." Here it is presumed that phrenology is something too gross to be appreciated but by those of untutored minds. But, contrary to this, we have Dr. Richard Whately, late Archbishop of Dublin, who as a logician stood among the first, giving it as his opinion that the metaphysics of phrenology are far more logical, accurate, and convenient than those of Locke, Stewart, Brown, and other writers of their school. Again, Mr. Abernethy, one of the highest medical authorities of his time, both believed and taught the doctrines of phrenology, and lectured on them to the Court of Assistants of the College of Surgeons of London. And in reference to the psychological classification by Gall and Spurzheim, Dr. Laycock, F.R.S.E., says, "I am inclined to adopt that classification as the best arrangement that could be adopted until our physiological analysis of mental phenomena has had a more scientific development." And Dr. Noble, M.R.C.S., says, "The harmony, indeed, of Gall's physiology with everything that is known of cerebral anatomy is so striking, that no one who examines this subject (free from bias) can fail to recognise it at once. It is really most unfair that Gall and Spurzheim should be so slightly passed over as they are in many modern anatomical works. This proceeding, indeed, has been the besetting sin of anti-phrenological anatomists, from Riel downwards. There have been a few honourable exceptions; but more generally the anatomy has been appropriated without any open or distinct acknowledgment." Without referring to other authorities on this subject, these are quite sufficient to make it plain that the article referred to was from one biased or perfectly heedless about "proof, or the value of evidence." Mention is also made of Lord Jeffrey having for a time extinguished the pretensions of phrenology in an article published in the *Edinburgh Review*, in 1826, in which he not only showed that the supposed faculties of the phrenologists had no separate existence, but also that they were not numerous enough for the requirements of life. If phrenologists had proclaimed that those of the mental faculties of which they knew, were the entire of which the mind consisted, then perhaps his lordship would have been justified in denouncing phrenology. But the intimate connection of the faculties one with another (which is explained by the fibrous nature of the brain, and consisting of so many lines of communication between the organs) and their power of co-operation, would sufficiently account for so many characteristics arising out of so few special faculties.

When Professor Ferrier had concluded his address on the localisation of the functions of the brain, Dr. Carpenter was the first to congratulate him on the success of his experiments, which, he said, tended to show that the real seat of the intellectual functions was at the posterior part of the brain, a view he had long since entertained. It was observed, however, in the article referred to above, that it is probable that Dr. Carpenter's view of the functions of the cerebral hemispheres will have to be modified or abandoned. And it is some consolation to find Dr. Carpenter, in a letter to the *Times* (Sept. 27), acknowledging the justness of this remark so far as it concerns the view he entertained that the cerebral hemispheres as the organs of thought "do not act in isolated portions, but as a whole." Perhaps the next concession that the experiments of Professor Ferrier may extort from Dr. Carpenter may be in the form of an acknowledgment of the untenableness of the position he holds in opposition to the doctrines of phrenology by maintaining that the intellectual functions have their seat at the posterior part of the brain

It was observed by Dr. Crichton Browne that Professor Ferrier located the memory of words in the very part indicated by the phrenologists as the organ of language. Since this much has been accomplished we may well hope for more. While the experiments of Professor Ferrier serve to demonstrate that particular parts of the brain have special functions, which fact was long since enunciated by the phrenologists, and though often disputed is now about to be established upon a scientific basis, students of this branch of enquiry will do well to watch the result of such experiments, although it does not seem quite clear how, by such experiments, it will be possible to ascertain what particular parts of the brain are connected with particular faculties of the mind, since these experiments are performed on persons only while under the influence of chloroform, in which state they are rendered incapable of manifesting any kind of mental exercise. The phenomena produced by Professor Ferrier's method being of a physical character, the limbs are made to move, but no thought or feeling expressed. The tongue, by the application of electricity, might be made to wriggle about in every possible direction, but this would in no way shew it to be the medium through which we become cognisant of flavours.

I should not have presumed thus to obtrude if my late friend Dr. Donovan had been living to vindicate the cause of phrenology in his more able manner.—I am, Sir, yours respectfully,

A. L. VAGO, author of "Orthodox Phrenology."

RAILWAY COLLISIONS.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—I beg to suggest the following plan for lessening the danger of railway collisions. I propose to have the locomotive and passenger carriages preceded by a number of trucks, connected with the locomotive and with one another by projections fixed to them, and by long poles fixed to the ends of these projections by a joint or hinge, these projections and poles being strong enough to push the trucks forward as the train advances, but not strong enough to resist the pressure of a collision. Suppose the first of these trucks to precede the locomotive by 200 yards or more, when a collision occurs the engineer reverses the engine, &c., or this is done by automatic machinery; the trucks and poles may be smashed, but before the locomotive and passenger carriages reach the obstruction, their velocity is so much arrested that the lives of the passengers are saved.

These trucks may be as useful in front as elsewhere; they may contain goods, cattle, &c. The necessary strength of the poles could be easily estimated; and the signal to the engineer or self-acting machinery easily arranged.

This plan would cause a little additional expense, and would slightly check the velocity of trains; but a little more expense, and a little less velocity, are surely more than counterbalanced by a little more safety.—I am, your obedient servant,

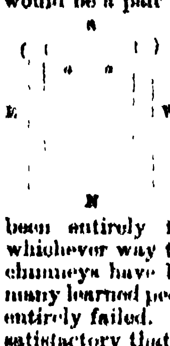
W. S. CARMICHAEL.

Annandale-street, Edinburgh.

SMOKY CHIMNEYS.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—I have had a communication with the Society of Arts on this subject, in which I mentioned the origin of my invention (I omitted to state, however, that about the year 1824, at a school in Charleston, South Carolina, we were all driven out by an irruption of smoke). About ten years ago my house in Wales became intolerable from the same cause, and I mentioned that during a ball, held at Denbigh, in the large room over the market, the company was visited by extensive puffs of smoke from time to time. I described the invention which has been already noticed in your pages. I am happy to say that public attention is being gradually drawn to the subject, but it seems easier to drive a tunnel through the Alps than to explain a very simple thing to our countrymen, and to get them to believe it. See p. 105, "Stephenson's Life." Locomotives in Newcastle, 1816–1820. It was decided to erect stationary engines on the Liverpool and Manchester line (p. 202). There is a well known ragged industrial school here, one part is built in the form of a Greek π, or perhaps a more familiar object would be a pair of nut crackers. There are



two chimneys about the points *a a*; they are surrounded on three sides by buildings. These chimneys naturally smoked more particularly with a north wind, but since the adoption of my apparatus they have been entirely free from that annoyance whichever way the wind blows. These two chimneys have been experimented upon by many learned people in Cheshire, all of whom entirely failed. The result of my plan is so satisfactory that several other chimneys in the same building have been provided with the same apparatus, and one of my neighbours, who is altering his house, has put one upon every chimney.

I am, Sir, your obedient servant,

C. BUTLER CLOUGH.

Chester, 20th Oct., 1873.

SIR SAMUEL W. BAKER is to give an account of the countries he has recently visited in the Upper Nile region, at a meeting of the Royal Geographical Society on Monday evening the 3rd November. On this occasion the ordinary meeting of the society, which would have been the 10th of the month, is changed, to suit Sir Samuel's other engagements.

IN a paper "On Nepaul Aconite, and on the Characteristics of the Aconitines," communicated to the Pharmaceutical Conference, Mr. T. B. Groves described the several alkaloids obtained from the aconites. He believes that there are two series of allied alkaloids—the one furnished by *Aconitum Napellus*, and the other by *A. ferox*, or some other Indian species. Each of these kinds of aconite seems to yield three distinct products, distinguished as crystallized aconitine, amorphous aconitine, and napellin.

DR. KENNGOTT, of Zurich, has lately studied with the aid of the microscope, some specimens of obsidian, or volcanic glass, from Iceland. One of the specimens exhibited numerous enclosures in the form of small brown hollow bodies, of globular and cylindrical shape, regularly arranged in definite series.

FRANCIS' IMPROVED CONVERTIBLE SCHOOL DESK

THE standard of these desks are made completely in wrought iron, welded and bolted or secured together A bar of extra strength is inserted in the upright portion of the back, to give greater strength and to form a knuckle to which a movable top is hinged The movable top is furnished with plates or brackets formed in L iron, with ratchet and tongue worked from the solid, and not welded on Plates are secured to the top by four strong iron screws, and to the standards by a bolt running through the said knuckle A longitudinal slot is provided at the end of a tongue The bolt has a head at one end, and is secured at the other by means of a slit pin with ends turned round the bolt By means of the longitudinal slot at the end of the tongue, the movable top can be moved to any angle and secured in desired position by means of tooth worked in the ratchet which catch in the upper portion of the standard The seat is secured to each standard by No 2 flat, round-headed bolts and nuts To make the desk and seat more rigid and free from rocking, stays are fixed to the under side of the seat and secured to standard by bolt and nut, and to seat by bolt and nut, and strong iron screw

The advantages gained by the above construction comprise amongst others, extreme lightness, and simplicity in arranging the apparatus for use either as desk seat with back, or as table

HOUGH'S SHIPS LIFE BOATS

BY this invention it is intended so to construct ships life boats as to be easily launched without loss of time so as not to be liable to be capsized either by the sea alone or on contact with the ship's side

The two ends of the boat are constructed separately from the body or centre portion The ends are (preferentially) made of conical form, and have closed air and watertight chambers, though such chambers may be filled, or otherwise rendered buoyant, if thought desirable On these ends flotation of the boat mainly depends, and they also serve as wheels on which the boat runs as it is launched into the water The two ends are connected by an axle or axles, and support the body of the boat therefrom In other respects the body of the boat is usually constructed like that of an ordinary life-boat

The inventor prefers to have the side seats and double bottom of the body watertight, to give stability when too much weight is placed on one side, and to add to the buoyancy; and also to place pipes in the bottom, to allow the water to pass through as it may come over. Boats thus constructed are not liable to be overturned by contact with the side of a ship, for such contact merely rotates the ends of the boat, without tending to capsize the body or centre compartment In case of the boat being under any circumstances capsized it is self-righting.

EXHIBITION OF APPLIANCES FOR THE ECONOMICAL CONSUMPTION OF FUEL AT MANCHESTER.

THE council of the Society for the Promotion of Scientific Industry, under the auspices of which body the above exhibition is to take place, having taken into consideration the enormous waste there is in the consumption of coal, whilst its cost is every day increasing, have resolved that an exhibition shall be held in Manchester of all appliances and apparatus that tend to the economic use and saving of fuel, for the purpose of inducing attention to, and eliciting opinions of practical men on the matter, and of giving all consumers of coal an opportunity of comparing the various appliances, with a view to their adoption of that which will best serve their purposes The exhibition will comprise—1st Appliances which may be adapted to existing furnaces &c., whereby an actual saving is effected in the consumption of fuel 2nd Appliances which may be adapted to existing furnaces, &c., whereby waste heat is utilised 3rd. New steam generators and furnaces, boilers, and engines specially adapted for the saving of fuel and appliances, whereby waste products are utilised, and the radiation of heat prevented &c , &c The exhibition will include appliances used for manufacturing, agricultural, and domestic purposes. Either the apparatus itself, or diagrams, or models may be exhibited, and no limit is placed upon the class of article to be exhibited. Exhibitors will be required to deliver their exhibits free of charge at the place of exhibition, and to remove them at the close of the exhibition. They must also erect them if necessary at their own expense Every exhibit must be accompanied by a full description, which must include a statement of the particular work the apparatus is intended to perform. A duplicate of this statement must be handed in when application is made to exhibit. Exhibitors will be given every opportunity of explaining the speciality of their apparatus. All articles are exhibited at the risk of the exhibitor, though every reasonable care will be exercised. Further information may be obtained from the secretary of the Society.—By order, William George Larkins, Secretary.

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THE
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*** *Communications to the Editor to be addressed to him at 21, Cockspur Street.*

CONTENTS.

THE INVENTORS' INSTITUTE,
4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

Chairman of the Council—**SIR ANTONIO BRADY.**

THE various efforts which have been made, and the numerous influences now at work to injure, if not to destroy, Patent Rights; the inefficiency of the many well intended, but ill considered, schemes of Patent Law Reform which have from time to time been suggested, and the tendency of which has generally been to prejudice the Inventor, without advantage to the Public, together with the proceedings so essentially involving the interests of Inventors which have already taken place in Parliament, show the necessity of an immediate and active co-operation on the part of those interested in Inventions and in Patent Property, and that an Association for the Protection and Defence of Patent Rights is urgently needed. This Institute has, therefore, been established for the purpose of uniting and organising the influence of Inventors, Patentees and others. Its objects are:—

1st. To protect Inventors' interests and defend the privilege of obtaining her Majesty's Letters Patent.

2nd. To promote improvements in the Patent Laws.

3rd. To facilitate the diffusion of information with reference to Inventions and other subjects beneficial to Inventors and Patentees.

The qualification for Annual Members of the Institute is a yearly Subscription of One Guinea, and for Life Members a single payment of Ten Guineas.

Persons desirous of becoming members are requested to forward their names and addresses to the Secretary.

APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur street, Charing Cross.

On August 19th.—2739 to 2746.—J. Weir. Sewing machines.—H. Kenyon. Apparatus for the manufacture of sulphate of soda, chlorine, hydrochloric acid, and cements.—T. Collier. Construction of umbrellas.—J. M. Goodall. Envelope-folding machines.—A. Théry. Purifying feed-water of steam boilers.—W. R. Newton. Treatment of felted, woven, and spun fabrics (com.)—W. R. Oswald. Steering apparatus.—J. Hanauer. Manufacture of table cloths or covers.—A. M. Clark. Construction of granaries and other receptacles for corn, part of which improvements is applicable in building houses and other structures (com).

On August 20th.—2747 to 2761.—R. Turner and O. R. Rollason. Arrangement for counteracting the weight of pendant sliding chandeliers, thereby superseding the use of counterpoising weights, with their attendant chains and pulleys, applicable to all such fittings required to be raised and lowered, without regard to the material used for illumination.—A. Young. Chains.—J. Musgrave and T. F. Shillington. Stoves and apparatus connected therewith for heating.—J. H. Johnson. Steam engines (com).—F. Villiers and J. Mayer. Apparatus for the impregnation of air for supplying the lungs or other parts of the body.—C. Knoblauch. Furnace grates. (Complete specification.)—T. Matthews. Making "diamond seating," which may be used as a substitute for hair cloth.—J. O. Spong and G. M. Spong. Apparatus for signalling between parts of railway trains, which improvements are applicable to signalling or attracting attention in other cases.—C. Carter. Apparatus for drawing and preventing waste of water from pipes, mains, cisterns, or other sources for domestic or other purposes, also for waterclosets.—E. T. Hughes. Panelling and moulding machine (com).—E. A. Thomson. Tools or instruments for spreading gum, paste, glue, or other uniting materials and liquids.—W. R. Lake. Traction engines (com.)—A. M. Clark. Apparatus for regulating or controlling the supply of gas or water in buildings (com.).—W. H. Hughan. Treatment of night-soil, sewage, and other like refuse matters, and in the production of materials capable of being employed for the purposes of deodorisation.—G. Haseltine. Solvent obtained by the distillation of crude turpentine (com.)

On August 21st.—2762 to 27[illegible].—J. [illegible]. [illegible] furnaces.—W. E. Edwards. Method of and apparatus for [illegible].—J. Hall, jun. Railway points or [illegible]—

W. G. Cumming. Sewing machines.—R. Gibbon. Manufacture of soap.—W. R. Lake. Machinery for hulling and separating rice or other grain or seed (com.)—A. Destony. Cigar holders.—S. T. Rowe and I. C. Johnson. Means of and apparatus for condensing and rendering harmless arsenious, chlorous, sulphurous, and other unpleasant and deleterious gases or vapours that are given off in the manufacture of Portland and other cements and limes, as well as in the treatment of mineral and metallic ores.—T. H. Rushton and R. Tongo. Machinery for spinning and doubling.—H. B. Barlow. Preparing peat and machinery employed therein, also manufacture of fuel (com.)—F. Cole. Railway signalling apparatus.—C. Catlow. Looms for weaving.—J. Greenwood and J. Dennell. Apparatus for piercing and for perforating leather or other like substances.—H. W. Hauberg. Process for separating or removing the tin from scraps or cuttings of tinned or terne plates.—M. Martin. Construction of balloons and other aerial bodies, and in the means of navigating them so as to control the direction in which they shall move or travel.—B. Sleap. Cinder sifter.—J. Wright. Method of treating zinc alloys for the purpose of recovering the zinc therefrom (com.)—W. R. Lake. Apparatus for the production of light from benzine, naphtha, and other like substances (com.)—W. L. Wise. Wheels for railway rolling stock (com.)

On August 22nd.—2781 to 2787.—W. Warren. Pumps.—L. M. Brachigny and J. E. Deschamps, fils. Machinery for obtaining motive power by means of water and air or other fluids.—A. C. Henderson. Mode of indicating or determining the difference of time between foreign countries, islands, cities, or towns as compared with that of England, the said improvements being applied to time pieces, clocks, or watches (com.)—A. F. Wilson. Apparatus for lighting and extinguishing public and other lamps or lights.—S. W Allen. Steam striker or hammer.—W. Pretty, jun. Corsets.—W. Smith. Apparatus for generating heat in steam boilers and furnaces.

On August 23rd.—2778 to 2791—T. Hyatt. Illuminating roofs and shutters and walking surfaces for streets, applicable also to the decks of vessels, and the construction and mode of securing the glasses for the same.—H. Zingler. Carriage lamps (com.)—W. Crookes. Treatment of waste or refuse animal or nitrogenous matters for the purpose of producing fertilizing substances or artificial manures.—R. Goodall. Means or method of treating and clarifying impure or waste water for fulling mills, scouring mills, or scouring processes, dyehouses, sewage, or other impure waters.

On August 25th.—2792 to 2797.—E. Kappmeyer. Sewing machines.—B. Hunt. Locks and keys (com.)—B. Hunt. Compound faucets (com.)—J. P. Clark. Improvements applicable to casks and barrels and other similar articles of manufacture.—J. Nickoll. Signalling apparatus and the lamps and lenses employed therein, the said improvements being partly applicable for use in ships and partly for other purposes.—J. G. Jones. Rotary engines.

On August 26th.—2798 to 2813.—J. H. Johnson. Machinery or apparatus for making bricks and similar articles (com.)—F. W. Jackson. Machinery for raising building and other materials, and which is called the "Excelsior" barrow hoist.—F. Olver. Flower-pot.—W. H. Skidmore. Buffer and coupling apparatus of railway carriages, trucks, and other rolling stock (Complete specification.)—W. Cunliffe. Machinery of metallic articles and structures for useful and ornamental purposes.—W. A. Brown. Railway trucks.—C. Harris. Machinery or apparatus to be employed in the manufacture of paper bags.—G. W. R. Campbell. Means or apparatus for preventing vessels dragging their anchors.—J. T. Standland. Improvements applicable to corn and other screens.—A. M. Clark. Means of utilizing the rise and fall of the waves for the propulsion of vessels (com.) (Complete specification)—N. W. Hornstedt. Method of establishing communication between a railway train and the stations or other part of the line of railway, and vice versâ, or between one train and another.—C. Schacher and L. Feret. Furnace for burning the waste or residue of wood or other vegetable substances, applicable to steam boilers and other industrial purposes.—B. J. B. Mills. Couplings for shaftings and in hubs for wheels or pulleys (com.)—B. J. B. Mills. Battery guns or repeating ordnance (com).—W. R. Lake. Machine for forming the internal screw-threads of gas fittings (com).—D. J. Kennelly. Distilling shales, coals, peat, and other bituminous substances, and the manufacture of peat fuel and peat charcoal in connection therewith, and the apparatus employed therein.

On August 27th.—2814 to 2830.—W. Housley. Construction of boilers for the generation of steam.—R. S. Norris. Arrangements and apparatus for preventing blown-out shots in mines and quarries.—A. Thomson. Construction of screw steam-ships.—T. A. Brockelbank. Apparatus for facilitating the connecting and disconnecting of the carriages of railway and other trains.—G. Hodgson. Construction of parts of looms.—J. H. Johnson. Mechanical puddling furnaces (com).—J. Crowley, jun. Grinding and polishing, and the machinery employed therein.—W. E. Newton. Machinery for hackling and combing flax, wool, and other fibrous substances (com).—I. Summers. Apparatus for economising fuel used for domestic purposes.—F. Osbourn. Machinery for cutting or shaping by what are commonly called band saws or knives.—A. M. Clark. Watch regulators (com.)—J. Durant. Means of administering medicines to horses, dogs, and other animals.—C. Farmer and J. S. Turner. Machinery for the manufacture of split cotter pins or lynch pins.—E. A. Cowper. Moulds for casting steel ingots.—W. R. Lake. Guards for the shuttles of looms for weaving (com).—F. Condit. Arrangement of harnesses and harness shafts in looms for weaving ribbons and other narrow fabrics.—H. Smith. Carving-forks.

On August 28th.—2831 to 2843.—G. A. Scott. Manufacture of brushes (com.)—L. R. M. Péan. Spinning tops.—J. Romance. Manufacture of capsules.—W. H. Maitland. Manufacture of gas, and apparatus employed therein (com.)—A. M. Clark. Umbrella and parasol frames (com.)—F. W. Follows and J. Bate. Lawn mowing machines, part of which improvements are applicable to machines for cutting the edges of lawns, and also to garden rollers.—W. R. Lake. Machines for trimming books and cutting paper, and similar materials (com.)—C. D. Abel. Process for the production of soda and potash from their respective haloid salts by the direct wet method (com.)—C. Crowther and T. M. Morgan. Apparatus for coating metals.—J. H. Johnson. Apparatus for generating hydrogen or carburetted hydrogen gas, and the means for evaporating the dilute acid employed in generating the gas (com.)—E. H. Leveaux. Method of connecting various metropolitan railways by means of a central station with each other and with the water traffic on navigable rivers.—W. J. Walsh. Gas chandeliers or gaseliers, and gas and other lamps.—P. A. Muntz. Process of and apparatus for condensing and collecting the fumes evolved by furnaces used for melting metals and for other metallurgical operations.

On August 29th.—2844 to 2854.—J. Macintosh. Compounds for waterproofing textile fabrics, also applicable to other purposes.—C. Cross. Manufacture of velvets, corded velours, and other pile fabrics.—H. Toulson. Drying cylinders, and the method of removing water and impurities therefrom.—G. Davies. Apparatus to be used in the manufacture of festooned edging or trimming (com.)—J Harrison. Apparatus for sharpening and gulleting the teeth of saws, which apparatus is also applicable for other similar purposes.—T. Westley and W. Westley. Sewing machines.—J. J. Purnell and R. Gorrill. Bush and closure for holes of casks or analogous vessels.—W. R. Lake. Railway carriage springs (com.)—F. Moline and T. G. Stock. Apparatus for filling sugar and other casks, and for compressing the contents during the filling.—P. S. Horsman. Machinery for spinning, doubling, or twisting fibrous substances.—C. E. Spooner. Mode of locking railway points.

On August 30th.—2855 to 2869.—R. Milburn and H. Jackson. Manufacture of fuel from peat and other materials, and apparatus employed in such manufacture, parts of which apparatus may also be employed in the filtration and drying of sewage deposit and other matters, and the moulding of bricks, tiles, and other articles formed from plastic materials.—C. Tyson. Means for supplying tar, oil, creosote, spirit, or other ignitable fluid or fatty matter to furnaces, and for promoting the combustion of such matters.—J. E. Barraclough. Kitchen ranges or fire-places, ovens, and boilers.—E. S. S. Darby and W. F. Hobrow. Machinery for sawing stone.—J. Schurr. Wool-washing and steeping machine.—J. C. A. Henderson. Treatment of peat and other substances, and apparatus therefor, part of which is applicable to other purposes.—W. Mitchell. Obtaining motive power.—R. Hattersley, C. Hattersley, and T. Hattersley and H. M. Ashley. Means of economising fuel and the apparatus employed therefor.—T. Roebuck and J. W. Lamb. Apparatus for ventilating.—G. Lowry. Machinery for drilling, boring, slotting, and wheel cutting.—S. Hallam. Construction of safety valves.—H. Bassett. Valve trumpets and French horns.—J. Coey. Package for butter.—W. Pearson. Production of fuel.—J. Shanks and J. Thyne. Steam boilers.

On September 1st.—2870 to 2878.—J. B. Stearns. Electric telegraph apparatus.—H. W. Hammond. Compound blower (com.)—J. Hill and L. S. Hill. Paving or forming the surface of streets or roads.—D. A. Fyfe and W. H. Bowers. Recovery of alkali from the liquid in which esparto, wood, straw, or other material has been boiled.—C. S. Smith. Apparatus for suspending pictures and mirrors, and for other like purposes.—J. Palmer, jun. Ram-warships and torpedoes employed in connection therewith (com.)—M. Henry. Steam engines (com.)—E. Johnson and C. Johnson, and G. F. Pabst. Presses for colour printing.—W. M. Adams, B.A. Astronomical instrument for exhibiting the position of the heavenly bodies with relation to the earth.

On September 2nd.—2879 to 2891.—W. Walker. System of separating, softening, and dressing hemp, flax, Manilla hemp, jute, rhea or china grass, New Zealand hemp or grass, aloe, and other similar fibrous materials, whether the same have or have not been previously prepared or manufactured, so as to render the same available for manufacturing or remanufacturing, or for use as oakum, lint, or tow, or for other purposes, and the machinery and apparatus therefor.—B. J. B. Mills. Sewing machines (com.)—J. Robertson. Indicating and registering the number of persons who enter and leave tramway cars, omnibuses, public halls, steamboats, or other places of public resort, and the apparatus or means employed therefor.—J. Palmer, jun. Turret ships (com.)—W. Thomas. Busks for stays and bodies.—E. H. Hatton and G. Hatton. Apparatus for building and releasing cords, ropes, and bands employed in connection with venetian roller and other window blinds, skylights, and house fittings and appliances.—I. Barker. Manufacture of spades, shovels, and other implements, and in the means or apparatus to be used therein.—J. Bird, J. Wirth, J. Fogg, and J. Oldham. Stiffening felt hats.—T. Arnold. Apparatus for heating the feed-water in steam boilers.—E. Edwards. Apparatus for producing optical and mechanical illusions in theatrical exhibitions.—H. Green and J. Barrow. Effecting the ignition of gas, and apparatus and means for opening the supply of gas to burners, for igniting the gas, and for extinguishing gas lights.—J. Parkes. Window-sash fasteners, also applicable to other purposes.—S. H. Johnson. Method of and apparatus for separating free sulphur from substances containing it.

On September 3rd.—2892 to 2905.—J. E. F. Lüdeke. Instrument for mechanical drawing and measuring.—L. M. Becker. Spools or bobbins for sewing purposes and in spindles therefor.—D. Mackay. Omphalic blisters.—W. A. Richards. Moulds for casting ingots of steel.—A. B. Childs. Windows in the doors of railway carriages to prevent dust and dirt from entering the carriages while in motion.—R. Sutcliffe. Apparatus for heating the feed-water for steam-boilers, and in the means or method of and appliance for cleaning feed-water heating apparatus.—E. Brasier. Machinery or apparatus for laying and forming concrete, asphalte, and other similar roads.—J. Whitehead. Machinery for spinning and doubling cotton and other textile materials.—J. C. Haddan. Envelopes (com).—E. H. Yarrow. Manufacture of gas for lighting and heating purposes, and in furnaces and apparatus for the same (com).—O. E. de Lorien. Apparatus for transmitting motive power, and for overcoming the usual loss of power at the dead points of rotatory machines.—W. Seibert. Weighing machines.—G. Hamilton. Mode of separating and obtaining gold, silver, and other metals from their ores (com).—G. Hamilton. Method of and means for [illegible] (com). (Complete specification.)

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Scientific and Literary Review,

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JOURNAL OF THE INVENTORS' INSTITUTE.

DECEMBER 1, 1873.

RETROSPECTS AND PROSPECTS OF PATENT LAW REFORM.

The opening address, delivered at the first members' meeting of the present session of the Inventors' Institute, by Mr Hume Williams, Barrister-at-Law, Vice-Chairman of the Council of the Institute, in consequence of its giving a general retrospect and clear exposition of the present prospects of Patent Law Reform, we deem worthy of the most prominent place in our journal. Mr. Williams began by stating that a few hours ago he was not aware that the honoured chairman of the Council, Sir A. Brady, would not be able to attend the meeting. He had, therefore, had but little time to prepare himself for his task; under these circumstances he must confine his observations principally to one topic, namely, the position of the Inventors' Institute in regard to the Patent Laws. There is (said Mr. Williams) no doubt in the world that within the last three or four years there has been a disposition on the part of inventors and others taking an interest in the subject, to bring the Patent Law question to a practical settlement. We have had, at the Inventors' Institute, on occasions when the Patent Laws have been discussed, men who differ from us on many points; we have had Mr. Macfie, and other known opponents to the Patent Laws, who had stated views in opposition to the existence of patent protection, and by coming amongst us they had found that the right to property in invention was far stronger than they had thought it, and they had gone away, he might say, satisfied that the patent question was a more difficult question than they considered it to be before they came to the Institute. In regard to the position of this question it was to be remembered that repeated inquiries had been instituted by Committees of the House of Commons and by Royal Commissions, which have reported thereon, but their deliberations have come to nothing so far as legislation on the subject of reform of the Patent Laws was concerned. Before anything as regards sweeping legislation takes place, experience has shown us that it seems desirable an intermediate or medium course is suitable to be adopted. Some reduction as regards the cost of affording protection to inventors is wanted, and that cost should be such as will secure to the original inventor the work of his own hands. There have been various plans spoken of in reference to improvement of the Patent Laws, and I was informed some time ago that a Bill was to have been brought forward in Parliament by the present Government, but that opposition, set on foot by the Institute, had put a stop to any legislation on the subject, the views of intelligent men, taking broad and liberal views, having been found to coincide with those of the Institute. But if a Bill were introduced that the Institute felt was just to the inventor's claims, then its support would be ready and hearty, and they have left the nature of their views in no doubt for the Invention Right Bill, an abstract of which was published in a recent number of the SCIENTIFIC AND LITERARY REVIEW, is a full exponent of them. I may remind you that within the last year a conference has been held in Vienna on the subject of the Patent Laws of various countries, and men of different views on the question have met on common ground to discuss whether or no it is possible that an international and improved Patent Law could be promulgated. The Institute, I am happy to say, was very efficiently represented thereat by one of our esteemed members of the Council, Dr. R. H. Collyer, whose outspoken opinion is to be found duly recorded in the Institute's Journal (The SCIENTIFIC AND LITERARY REVIEW). Some common settlement was sought to be urged, and some model of an existing law it was suggested should be taken, as, for instance, that of England or of America, so that instead of seeking one protection in England, another in France, another in the United States and so on with each individual country, one law should embrace the whole. Although the Institute is still working on in hope of speedy success, strongly striving as it has been from the commencement of its existence for the great desideratum of a sound Patent Law, yet I am afraid that next year will see no further solution of the question than at present, for various other matters of greater political interest will take up the time of the Legislature, and further, considering that this Parliament is moribund, we cannot hope that the solution of the question can be brought to a practical issue till the next Parliament meets, but we hope that when that solution is sought to be attained, the law will give protection to every inventor, not as now, upon payment of exorbitant charges, which literally confine patent protection to the monied portions of the nation. Not long since I met Mr. Webster, Q.C., and he expressed his hope to have been present this evening, and take counsel with the Institute, so that a practical settlement be brought about, for it must be remembered that the Institute, by its members, expands itself all over the country, and it is imperatively necessary that their views should be heard and considered, and, above all, the pecuniary position of such inventors as belong to the working classes, who are a large proportion of the great body of inventors at present. The original inventor, when a poor man, prefers to take his invention abroad, where, for a very small outlay, the fruit of his mental labour can be protected. We hope in the course of the ensuing session of the Institute that the matter may be again discussed, and some steps taken for the settlement of the improvement of the Patent Law, or, at least, measures for obtaining a great reduction of patent fees, set on foot. It may be thought that when our views on the Patent Laws are accomplished that the Institute will retire from the field as having done its duty; but this is far from the case; our principal desire, after having an improved law, will be to develope inventive genius, and make the Institute an organisation where the practical and working man may promulgate his ideas. And, indeed, the Council has it in contemplation to offer relief. If any working man can satisfy the Council of the Institute as to the utility of his invention, then, after being thoroughly examined into, the Institute might afford him the means of protecting his invention, that is if such a course could be adopted with success, and, further, might give him the aid of its counsel in practically developing his ideas, and it is my hope that the Council may see its way clear to arrange that any practical workman who can during the year show that he has made such improvements in machinery or manufactures as conduce to great advantage in any branch of manufacture, shall have a medal awarded to him, of, say, ten guineas value. Mr. Williams then referred to the loss the cause of Patent Law Reform and the Institute had sustained by the death of its late Secretary, Mr. Latham, who was one of its founders, and one whose energetic and able efforts had done more than those of anyone else to place the Patent Law question on a right basis, and render the Institute useful and important; although comparatively young ([illegible] years old) he possessed the practical knowledge and business talent of a man of the most mature age, and his memory was endeared to all who knew him for the many genial and generous qualities of his character. Another loss to the Institute was occasioned by the death of Mr. Cornelius Varley, an nonogenarian veteran of science, whose talent and estimability were so well known as to render eulogy superfluous. Mr. Williams then proceeded to make some remarks as to the conflicting interests of capital and labour, which, he said, were likely to force themselves upon the consideration of the Inventors' Institute, and concluded by requesting the Secretary (Mr. Campin) to state what arrangements had been made as to the various meetings to be held during the session.

General Literature.

A Treatise on Medical Electricity, Theoretical and Practical, and its Use in the treatment of Paralysis, Neuralgia, and other Diseases. By JULIUS ALTHAUS, M.D., M.R.C.P. London, Physician to the Infirmary for Epilepsy and Paralysis. Third Edition. Enlarged and Revised. With 147 illustrations. London: Longmans, Green, and Co. 1873.

THE last edition of this very valuable treatise being out of print, Dr. Althaus has carefully revised the book, and incorporated with it the results of all the recent work done in this department of science. Not only has a large amount of new matter been added, but the pruning-scissors have been freely used for eliminating what was no longer required, either in disposing of now antiquated theories, or in proving facts which have since then become self-evident. The quantity of new matter in the present edition is therefore much more considerable than would appear merely from the increased size and number of pages. The physiological part of the subject has been carefully brought up to the level of the day; the chapter on diagnosis has been amplified, special attention having been drawn to the value of faradisation in detecting malingerers, and as a test for death soon after its occurrence; the clinical chapter has also been rendered fuller, and enlarged experience has enabled Dr. Althaus to answer the numerous questions connected with the therapeutical use of electricity in a more precise manner.

Dr. Althaus remarks that the electrolytic treatment of tumours has been much practised in the interval between the appearance of the second and third editions; and although, as he truly says, this particular branch of the subject appears to be still in its infancy, yet indications are not wanting that it will soon occupy a far more important place in therapeutics than many eminent surgeons were willing to believe, when he first suggested this plan of treatment six years ago.

The author of this treatise is so well known as an eminent authority in his branch of medical science that it is scarcely necessary for us to speak in praise of the work before us, which as now presented to the world by this third edition is an elaborate and exhaustive treatise ranging over the entire subject of electricity and its application to medical uses; for he does not confine himself to the bare details of the medical applications of electric power, but gives ample information as to electricity and electrical apparatus of various kinds, and then describes their medical uses.

The work being thus comprehensive in its range, and hence including much information on practical electricity, we are at a loss to select a specimen of its contents, the subject matter of which has not already been introduced to the notice of our readers. Perhaps the following, taken from the chapter on electro-therapeutics is as good an exemplar of what is peculiarly noteworthy as any part of the work.

Referring to the course to be adopted in regard to the extent and duration of the application of electrical treatment, Dr. Althaus observes—"A good rule for practically settling such question is the following: *Discontinue the treatment when the patient ceases to improve, or when he gets worse instead of better, or when symptoms of galvanic saturation of the system begin to make their appearance.*"

In speaking of a saturation of the system with galvanism (a subject to which no previous writer has alluded), "I do not," says the Doctor, "mean a material accumulation of the galvanic fluid, which could be compared to the accumulation of certain poisons, such as arsenic, strychnia, or digitalis; of those we know that sometimes, after having been given in minute doses for a certain period without apparent effects, they suddenly cause violent symptoms, which must be traced to an undue quantity of them having accumulated in the system. But, while arsenic may still be discovered in the system ten days after the last dose has been given, the galvanic current ceases to circulate as soon as the application is over. It is, therefore, only the *effects* of the application of galvanism which can give rise to symptoms of saturation Faradic electricity never seems to lead to such symptoms at all, probably because it has no or only slight constitutional action. The continuous current, on the other hand, which has a far more profound influence on the central nervous system and all the processes of nutrition throughout the body than Faradism, not unfrequently causes symptoms which if present should induce us to discontinue the treatment, at least for a time. The most striking of these symptoms I have found to be *a persistent galvanic taste*, which does not disappear, as it generally does, immediately or soon after the application, but lasts the whole day and night afterwards, and sometimes even longer. Other symptoms of galvanic saturation are disturbed sleep, restlessness, singing in the ears, vertigo, and a general sense of lassitude If these are perceived in the fourth, sixth, or eighth week of galvanic treatment, they show that the system is becoming over-polarised, and that the galvanism has ceased to be useful. I have never continued the treatment under such circumstances, for the mere purpose of seeing what degree of over-stimulation might be reached, and what amount of harm a continued application might do in a given case. I am, therefore, unable to say what would be the result of such a proceeding. But I have no doubt that serious mischief would result by continuing the treatment contrary to common sense in such cases: just as we know that harm is done when the use of arsenic, digitalis, or strychnia is pushed beyond reasonable limits. As a rule, nothing but discontinuance of the galvanic treatment is required for relieving symptoms of saturation, but if hyperæsthesia should be marked, twenty grains dose of bromide of potassium two or three times a day for a few days a week would be appropriate."

Spirit and Mind Polarity; or, the Disentanglement of Ideas. By ARTHUR YOUNG. First part. London: Houlston and Sons: Worthing: W. Paine.

To afford our readers any definite and distinct notion of the true character and contents of this work is a matter of extreme difficulty. It seems to be an *exposé* of the phantasms of a religious metaphysician, who considers he has found in the Cross an apt means of formulating his views as to many mental, moral, and religious theorems; and in order to make this perfectly plain to the reader, the author has given several illustrative plates, showing forms of ornamental crosses, the arms of which have words running into and crossing each other. Possibly these remarks may leave our readers with the notion that the work is wanting in rationality, though it is really a production well worthy of attentive perusal, as developing ideas which, if not so novel as they at first appear, yet have the merit of being put in a very striking way. Perhaps as good a notion of the *rationale* of the author's system may be obtained from his preface:—

It is now many years ago that the germ of the work actually presented in its fuller growth, was first laid in my mind, by the pressure of an earnest desire at the systematising—or formulating and imaging to myself succinctly and fixedly, or upon one invariable and also condensed plan if at all possible—the more fundamental Ideas of Moral and Mental and also Social and Religious Philosophy, as treated of by a great variety of writers in an equally great variety of often-times confused and contradictory ways; and the germ thus laid being that of the Idea of the Antithesis and yet Interconnection of the Spiritual and Material—or the Idea of a Trinity in Unity, of Active or *Moving* Spirit—Passive or *Moved* Matter—and their mutual interconnection in some resulting Neutral or Mathematical *Movement*—a movement, that is, in *lines* of some sort, and which I symbolized thus:

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MATTER.

I was then led, in the first place, to more complicated symbolical figuring, and was only recalled from the path thus entered upon, to the simplicity of the actual Method, to the Method indeed from which I had originally started, by stumbling accidentally, as it were, but at a very critical period of my elaboration, upon the following passage in Dr. E. H. Nolan's History of British India.

"The Buddhists of Tartary used the sign of the Cross as a charm to dispel invisible dangers, and reverenced the form of the Cross in many ways . . . . . . In every nation possessing a Creed or a Philosophy the same sign has been used. . . . . . . At Nineveh it was found among the ruins as a sacred emblem. In Egypt it was similarly used, as is well known. The Spanish priests were astonished to find the Cross worshipped in Mexico."

Mr. Young, after further remarks of similar character, adds —

My employment of the term "Mystery of the Cross" on the title-page of the First Edition was, therefore, in allusion to the mystery of the symbol of the Cross, having thus led the van of Man's Progress since Man was. But the mystery is now made plain! It so led the van, because around that Ideal, all the other Ideals of man, the Ideals of his Soul-Affection and Body-Sense, of his Mind's Instincts and Intellect are found to entwine as the heart-strings entwine with the heart itself. What leads Man on if it be not Ideas? And if so, could it be otherwise than that the Idea of Ideas,—the Idea, namely, which carried along with it the supreme law of their joint ordering, for the purposes of Man's Good, Man's Happiness, and Man's Perfection, should be held aloft in all ages and all nations by the leaders of their kind?

But I need not comment farther. Whether the outburst was one of mere idle, or of truthful enthusiasm, will be decided, according as the work itself is recognised or denied, as in conformity to the truth or actuality of Man and his circumstances; and I shall, therefore, probably best complete this part of my task, by stating more particularly, but shortly, in what the work consists.

The work, then, consists of three plates or diagrammatical representations of the Idea of Man:—

Firstly, as an embodiment of Self-law-giving Energies which issue as Will;

Secondly, as *conditioned* or *put together* with an external of other beings and things, and therefore as *willing* a Destiny of Society and Industry; and

Thirdly, as willing and determining the *Ends* involved with the Destiny of the Second Idea of Man, and therefore also with the Idea of the fundamental Spirit or Self-law-giving Energies of the First—which Third Plate or Third Idea with explanatory Text will, however, constitute the Second Part of the work; the First and Second Plates or First and Second Ideas of Man being alone contained in the First.

A Phrenologist Amongst the Todas, or the Study of a Primitive Tribe in South India. History, Character, Customs, Religion, Infanticide, Polyandry, Language. By WILLIAM E. MARSHALL, Lieutenant-Colonel of Her Majesty's Bengal Staff Corps. Permanent illustrations by the Autotype process. London: Longmans, Green, and Co. 1873.

THIS is a pleasant, and withal instructive, work, one that will be read with pleasure by the general reader, the phrenologist, and the ethnologist; its title, to a certain extent, developes its character, but the following statements extracted from its opening pages convey a good general idea of its contents.

In the course of a furlough (says Col Marshall) I took in the year 1870 to the Madras sanatarium of Utacamund, in the Nilagiri mountains, commonly called "Ootacamund, in the Nilgherry hills," I heard much of an "aboriginal race" living in the neighbourhood; which, infanticidal and polyandrous, was said to be fast dying out.

I had long been curious to understand the mysterious process by which, as appears inevitable, savage tribes melt away when forced into prolonged contact with a superior civilisation. But, ignorant of all the languages of South India, I should have relinquished the attempt to study the Todas had I not had the great good fortune to make the acquaintance of the Reverend Friedrich Metz, of the Basel Missionary Society, who had spent upwards of twenty years in [illegible] among the primitive tribes [illegible] inhabitants of the Nilagiris, and who, in addition to being skilled in several Dravidian dialects was exceptionally practised in High Kanarese and Tamil. Above all, he was the only European able to speak the obscure Toda tongue.

Mr. Metz most readily agreed to co-operate with me in strict inquiry into the condition of the Todas and henceforth became my sole associate in all expeditions amongst them—save one or two—and it is the more proper and just that I should in this place render Mr. Metz the warmest acknowledgment of the very disinterested and important share he had in the undertaking.

Our operations began with a census of a portion of the tribe combined with an examination of each of the families that came before us. But in proportion as our work advanced, so did interest in the subject develop, until the scheme was entertained of enlarging the topic from its original design, so as to embrace "a study of the manners and customs of a primitive race of man."

With this evolution grew also the desire to describe what I had seen, as to enable readers who could never have an opportunity of witnessing life amongst untutored races, to realise justly and without exaggeration, what it really is, and—by analogy—what it must have been in the pre-historic era, long ere "Adam delved and Eve spun," before man had much developed in manly qualities.

Whilst hoping, though not without some misgivings, that the ugly statistics collected with so much care, and the speculations advanced to account physiologically for the origin of obscure customs, may have some slight value, even to the *savant*, I am sanguine that the antique practices now brought to light, and the illustrations I have attempted of every-day life, may render the book acceptable to the general reader. I may say, that great and especial pains have been taken to render as large a portion of the work as the subject permits, attractive, and suited for ladies' reading.

A few words of explanation are perhaps called for, to account for my having devoted an entire chapter to the description of some of the first principles of phrenology—a subject which is fully treated in standard works by acknowledged authorities. I wished primarily to show the premises forming the basis for many conjectures which otherwise would have borne too much the appearance of dogmatism, or that might have been misunderstood. Secondly, I desire to show for phrenology, a marked practical value for ethnological purposes; and no single work containing, with clearness and brevity combined, so much information calculated to be serviceable to enquirers disposed to pursue the phrenologic mode of enquiry into the nature of barbarous races, which I have here faintly attempted, I trusted that the chapter might be useful, in some sort, as a manual for ethnographers so circumstanced.

But in this matter, as indeed throughout the book, I must trust very much to the lenient judgment of my readers, if, as a solitary Indian, far away from contact with men of science, but fresh from the actual and impressive presence of "nature's children," in attempting to work out for myself some of the vastly interesting unsolved problems of our day, I air some seemingly quaint ideas. The public is concerned simply in their truth.

Col. Marshall invites especial attention to the important contributions made by the eminent philologist and great Tamil scholar, the Rev. G. U. Pope, D.D., at present Head Master of the "Bishop Cotton" School at Bangalore.

Further on he acknowledges himself indebted to the Honourable Sir A. Arbuthnot, C.S., K.C.S.I., Secretary to the Government of Madras, for having placed at his disposal, the record existing in the Revenue Department, on the Subject of Toda infanticide.

In carrying out his views as above adverted to, Col. Marshall first gives an outline of the history of the Todas, then states his phrenological basis, the physiology of the Todas, their characteristics, the land they live in, their habitations, family arrangements, food, savage antitype, census, family statistics, religion and priesthood, their ideas as to the future state, funeral customs, infanticide, polyandry, and concludes with a description of the Toda language.

Although the book is one of considerable interest, it is difficult to extract any passage of a striking character, for the Todas, as a race, seem to be the most matter-of-fact, unambitious, and quiescent of men, leading what may be termed a pastoral life, in tending herds of buffaloes, which are quite sacred beings. Milking and butter-making appear to be the *summum bonum* of their existence; the dairyman and priest being one and the same person, and the village dairy the parish church of the Todas. It seems, however, that they have in their country some structures as mysterious as the Round Towers of Ireland, and that these are considered religious edifices. Perhaps the most amusing portion of the work is that in which Colonel Marshall narrates his night visit to one of these edifices, which consist of a conical thatched roof on a circular wall of very stout planking. The wall is about four cubits high, the whole edifice some fourteen or fifteen cubits tall, and six cubits in diameter. At a distance of approximately six cubits, the temple is surrounded by a massive wall of uncut stone, put together without cement, two cubits broad and three in height. The apex is crowned with a large stone, placed there apparently with the object—however inadequate the conception—of steadying the roof, or perhaps excluding rain from that weak point.

Selecting a dark night for the purpose, and accompanied by a friend, who, says Colonel Marshall, I had better at once state was not the reverend companion who has been my steady associate in all innocent, if somewhat inquisitorial visits—I walked over the hills on burglarious intent. What should I do, I thought, as I went along, if I really met a valuable relic, say some 2,000 years old, with an inscription on it? Who is it is said to have said that every man has his price? I had mine. Were I only to find a signet ring, I was ripe to commit theft in addition to the minor crime of breaking into a savage man's temple. The burglarious entry, as the Colonel relates it, appears to have been no mean feat of burglary, for the doorway was so low and narrow, that even taken anglewise it was found to constitute a close fit for full grown men. However, the inquirers both crawled in, and found the temple divided by a thick wooden partition wall, and a small doorway in this wall of the same dimensions as the first, and midway between the two doorways, at the level of the floor, a vat or basin of about half a cubit square, made of stone. We looked, says the Colonel, continuing his narrative, through the interstices of the clumsy slabs of the dividing wall into the next room. That, at any rate, is not empty. It is the *sanctum sanctorum* where the relics are kept. Once more! In through the little door of the dividing wall. Quite easy now! First squat square opposite to it like a frog, next supple the whole body, then go in cornerwise with *élan!* Don't attempt to rise till you are five feet off on the other side. This feat can be practised through a window frame on the ground level. Just looking round at the little door, more in sorrow than in anger, we proceed to business. Earthenware pots, honnus, and a whirl with which to churn butter by revolving between the palms of the hands. No bell, no hatchet, neither ring nor relic of any kind, no niche for lights, no altar, no stone, no phallus or lingum, no snakes! Everyone has been telling us lies, and the world is full of sawdust! Back through the two doors quickly like prairie dogs. Out into the open air. The transition was as if we had been born again. Now to philosophise. This is a very simple religious faith! How many negatives go to prove a positive. One thing is clear, every priest must be long in the back and very fond of milk! But why were the doors so unusually small, and why locked, and why these fusty lies about relics?

Subsequently our author was enlightened on this matter, upon remarking to a Toda man that the people of the village said there were relics in the temple. "Do they bury them in the ground?" He glanced sideways at his questioner, and by his countenance enjoined him silence. With his hand to the side of his mouth, he said in a low tone, "Under the stone on the top of the roof."

Milk, Typhoid Fever, and Sewage; a Series of Letters by Alfred Smee, F.R.S., F.C.S., Chairman of the Vegetable and Fruit Committee of the Horticultural Society; Medical Officer to the Bank of England. London: Printed by W. H. and L. Collingridge, 117 to 120, Aldersgate-street. 1873.

NOTWITHSTANDING the deservedly high estimation in which Mr. Smee is held as a chemist and medical practitioner, we are by no means prepared to endorse the wholesale condemnation of sewage grounds, which he enunciates in this little pamphlet, although we are quite ready to oppose the notion seemingly entertained by many sewage irrigators that too much sewage liquid cannot be applied to the land, for, doubtless, like many another chemical admixture, more liquid may be applied to the land or crops than it can readily absorb; but, because this may happen under improper management, to therefore conclude, as Mr. Smee appears to do, that sewage irrigation is too questionable as to sanitary harmlessness to render it an object of distrust to all true advocates of sanitary progress, is to us a *non sequitur*. So far we demur to Mr Smee's views on this question; still, we believe that, taken *cum grano salis*, they are worthy of careful consideration. We therefore present

our readers with the following extract, which will afford them a general notion of those views:—

A farm with sewage on it, and a sewage farm, must be held to be pestilential, death-producing swamps, until the sewage is disinfected. Nature should be followed, and manurial matters in the putrid state should be changed to mineral matters before they are absorbed by the plants which feed upon them. [Though how this is to effect the object in view is rather puzzling, seeing that Mr. Smee has previously told us that nitre in water condemns it for use, because the nitre, although at the moment utterly changed to chemical salts, *may have come from the nitrogen of previous sewage contamination*, p. 10.] Theoretically, earth disinfects the sewage. In practice, as now managed, part of the sewage never gets into the earth to be disinfected, as the whole is spread over the waterlogged ground, where it exhales its pestilential gases. Cows, whilst it is so spread over the field, drink some; blades of grass attach to themselves solid particles, and plants take up other particles in their juices. Notwithstanding this absurd deviation from the ways of nature, sewage farmers, engineers, speculators, and others living by the promotion of sewage farms, recommend sewage farms as now conducted as the source of all sanitary good. All men know that if we do not return to the ground that which we take from the ground the earth will not restore to us its usual crops. Sewage farm speculators assume that they alone know this great fact, and are always demonstrating it to draw off attention from the infraction of the laws of nature. If they return sewage to the land they care not in what state they apply it, and either do not know, or pretend not to know, the danger they incur. The gardener who makes up his hotbed sweetens his manure by fermentation, when ammonia is produced. The rootlets of his cucumbers and melons run in the manurial mass, and sweet and wholesome produce is obtained.

The gardener also uses liquid manure with care and caution in certain stages of the growth of a plant. He particularly abstains from giving the ripening strawberry such manure, as he knows that his fruit would be corrupted. The sewage irrigators, regardless of consequences, use putrid manure at such a period that the plants are dangerous to animals. They do not know, or they care not for the fact, that vegetable dyes, as madder, will permeate an animal and colour its bones, which demonstrates to all physiologists how animals are affected by the food they eat. Much more may be said upon the effect of sewage vegetation upon cows and sheep used afterwards for human food, which must be considered at a convenient season. Sewage promoters say that they can conduct their farms with safety to the community. Take them at their word, and if any complaints fairly arise from mismanagement, let the delinquent be fined £100 a day for every day a sewage farm is mismanaged.

Chemistianity (Popular Knowledge of Chemistry): a Poem; also an Oratorical Verse on each known chemical element in the universe, giving description, properties, sources, preparation, and chief uses. Arranged for familiar or memory reading. By J. Carrington Sellars, F.C.S. Published by the Author (at his Office), J. C. Sellars, Ferry-buildings, Birkenhead.

This is a work so unique that it is difficult to criticise it. The author essays, by the use of measured lines (or oratorical verses, as he terms them), such as may be readily read aloud in an elocutionary manner, to enable a student to obtain and retain a brief knowledge of chemistry, his notion being that this form of writing will be found more impressive than ordinary prose statements. That verse is more effective in its memory action than prose everyone will admit who calls to mind the fact that the juvenile poetry of good old Dr. Watts is perhaps more efficient mental pabulum than anything in our language.

There is no doubt that the verse is peculiar, and that the occasional use of newly invented words renders it still more remarkable; but, for all that, we incline to the opinion that the work will be likely to prove useful in the way which the author wishes it to be.

As a specimen of the contents of the book we offer the following to the notice of our readers:—

Crystals belong to one of six systems:
First, or Regular System, like Alum,
Common Salt, Iron Pyrites, or Fluor Spar.
Second, or Quadratic System, like Tin
Dioxide,
Or the Yellow Prussiate of Potash.
Third, or Hexagonal System, like Quartz,
Calc Spar, or Ice as seen in Snow Crystals.
Fourth, or Rhombic System, like Native
Sulphur,
Barium Sulphate, or Common Nitre.
Fifth, or Monoclinic System, like Borax,
Sodium Carbonate, or Cane Sugar.
Sixth, or Triclinic System, like Copper,
Sulphate,
Boric Acid, or Potassium Bichromate.
The non-crystaline arrangement in Plants
And Animals is termed Cellular Structure.
Substances of no set shape are Amorphous,
Such as Glass, Glue, or Silicate of Lead,
When the same body occurs crystalised.
In more than one system it is Dimorphous.
Crystals from Native Sulphur and Sulphur
From Fusion are of two different systems.

The work is handsomely bound, is printed on good clear paper with new type made expressly for it, as it appears, and we cannot consider it as a production otherwise than creditable to author, printer, and publisher.

Elementary Treatise on Physics, Experimental and Applied. Translated and Edited from Garrot's Éléments de Physique. By E. Atkinson, Ph.D., F.C.S., Professor of Experimental Science, Staff College, Sandhurst. Sixth Edition. London: Longman, Green, and Co. 1873.

Though an old aphorism says that "Every dog has his day," we may also say that "Every scientific work has its day," the day with most of them being very short indeed, there being only a very small minority of works of which it may be said that their day extends considerably beyond the generation in which the work was first published; yet it may be fairly assumed that the day of this work is to be of indefinite length, for although its duration has up to the present been comparatively short, still, as will be seen, it has reached its sixth edition, and now sustains the same high character for merit which it received when first issued; for, although a translation from the French, there is not a work, to our knowledge, by an English author, which sustains so high a merit as this does; but in fairness it may be said this is partly owing to the able hands into which the translation has fallen. The present edition brings the text up to the latest discoveries in the various sciences into which the work is divided, and these comprise an addition of thirty pages of matter over the previous edition, the new matter referring to those subjects which are calculated to take a permanent place in elementary instruction. Three coloured plates, besides twenty-one other illustrations, are also added, and that portion of the work bearing upon Physiological Electricity has been carefully revised by Dr. Martin, of Cambridge.

We cordially recommend the present edition of this standard work to those interested in teaching, and also to the inquiring student, and we doubt not that as the former editions have always proved a source of pleasure and profit to them, so this last edition will be more so; we have not the least doubt, it will prove so by reason of the important addition referred to.

Workshop Receipts. For the Use of Manufacturers, Mechanics, and Scientific Amateurs. By Ernest Spon. London: E. and F. N. Spon, Charing Cross, London.

Up to the present time any person seeking to find out a suitable receipt or formulary for a particular construction or process in any trade or handicraft, has been compelled to refer to various works bearing upon the particular branch of trade in question, and this search has often resulted in the mortification of finding no mention made of the subject. Beyond which it is not always convenient or practicable to obtain works where the desired information can be found. Therefore our thanks are specially due to Mr. E. Spon for compiling, in the form of a small book, an amount of practical information which will be vainly sought for in many ponderous tomes. In glancing through this work we have been convinced that the various processes, &c., have been taken from the best authorities, and that the task of compilation has fallen into able hands. The preface states that the work has been written to effect three purposes—to serve as a note-book for the small manufacturer, to supply the intelligent workman with information required to conduct a process foreign, perhaps, to his habitual labour, and impart to the scientific amateur a knowledge of many processes in the arts, trades, and manufactures, and we think that not only to these classes of individuals will the work be specially interesting, but to others who do not come within the classes above mentioned, for there are some of the receipts or processes in this work which would prove of great service to the housewife. It is not a work where we can give extracts of the different portions of the work, as it is of that character where one portion is of equal merit with the rest, although in saying this we should state that we think there are some receipts or processes which would have been as well to have left out, but these form a very minute portion of the work, and do not in any way lower the character of the book in the excellence of its information, and for this reason we recommend it to all those who have anything to do with processes or technical receipts of various kinds.

SCIENCE SIMPLIFIED.

Reviews of Treatises on "Light," embracing Reflection and Refraction of Light, Light and Colour, Spectrum Analysis, the Human Eye, and Polarised Light. By J. H. Pepper, late Professor of Chemistry and Honorary Director of the Royal Polytechnic Institution. London: Frederick Warne and Co, Bedford street.

"Heat," embracing Thermometric Heat, Conduction of Heat, Latent Heat, Steam. Same author.

"Pneumatics and Acoustics," "Chemistry," "Electricity," "Magnetism."

The whole of the above books seem to be parts of the "Science Encyclopaedia" published by Professor Pepper some few years ago, when he was Professor at the Polytechnic, and the works before us are, as far as we can judge, a bringing together of the various interesting experiments, novel and otherwise, which were brought before the public during the time of his Directorship of that institution, proving a source of instructive amusement to those who witnessed them. We think, however, that they cannot be considered as *par excellence* class books or text-books for students who may be studying one or all of the above mentioned branches of science. But to a certain class of readers these works will be acceptable, though to those who are aspiring to obtain a systematic knowledge of these different

branches of science, we are of opinion they will not be of any great value. The class to whom they will be particularly useful is that of popular lecturers, whose aim is not so much to teach these various branches of science in a technical way as to convey general scientific information and afford amusement to an unscientific audience, by which term we mean an audience not assembled as scientific students, but who have come to obtain information in an amusing way. Hence, in our opinion, to that class especially they will be welcome, and in this sense we deem them works worthy of commendation.

Perhaps, after all, looking at the fact that nearly every enterprising publisher now-a-days brings before the world a series of elementary books in science, it is well that Professor Pepper has presented us with something of a different character.

Manuel Pratique de Procedure Anglaise, et Recueil de Lois à l'Usage des Français et des Belges, dans leurs Relations d'Affaire avec l'Angleterre. Par JOHN RAND BAILEY (8, Tokenhouse-yard, Londres), "Attorney" près les Cours de Common law et "Solicitor" près la haute Cour de Chancery de l'Angleterre Londres: Hachette et Cie., 18, King William-street, Strand. Paris: Cosse, Marchal, et Billard, 27, place Dauphine

THIS little work, by a practising attorney, is in every sense what it professes to be—a practical handbook of English legal procedure, and we can highly recommend it to foreigners, to whom it cannot fail to be of the utmost service, whenever it may be necessary for them to take or defend legal proceedings in England. Such a treatise was much required, and will greatly facilitate commercial and general intercourse between French-speaking countries and England.

Information is supplied under separate heads for most cases in which foreigners usually require a knowledge of English law, including the law of debtor and creditor, bankruptcy, liquidations, joint stock companies, patent for inventions, literary and artistic copyright, naturalisation, wills, extradition, &c., &c. At the end of each chapter are practical instructions as to the steps and proceedings necessary in each case, together with a collection of valuable forms.

"Student's Class-Book of Astronomy." By Francis Bullock, LL D. (Relfe Brothers.)
"First Book of Geology." By William T. Davis, LL.D. (Collins and Sons.)
"An Easy Introduction to Chemistry." Edited by the Rev. Arthur Rigg, M A. (Rivingtons.)

We notice the issue from the press of the above Science School Books.

TOLSON'S LIFE SAVING BUOY-VESSEL.

THIS very ingenious device comprises the use of a watertight vessel, the lower part of which is hemispherical, and the upper part conical, or nearly conical, the figure of the whole being that of an inverted balloon or pear. This vessel is made of copper or other material, combining lightness with strength. The lower, or hemispherical, part is provided with a close fitting casing or covering of cork, or other buoyant material, and the said casing may terminate at the top in a flange or broad belt of cork or other buoyant material, though the inventor does not recommend this, but uses in lieu thereof a flange or girder-like projection of metal, shaped like a V, or nearly so, and of width sufficient to enable a man in tolerably calm weather to stand upon it and hold it by a guide rope, which will be rove around the vessel, underneath the entrance, and from which point signals may be given, lights displayed, and so forth. Different coloured lights, likewise, can be arranged as fixtures for night use, so that the appliance can be seen by passing ships.

In the interior of the said hemispherical part is a floor, having upon it a number of seats. Underneath the floor is a space for ballast or merchandise, and the seats for passengers also serve as water tanks and lockers for provisions. Leather belts are attached to the seats for the purpose of securing the passengers. In the upper or conical part of the vessel is a series of narrow panes of thick glass, for the purpose of admitting light, and about midway up the said conical part is a door capable of being opened, closed, and fastened, in the inside. This door is for the introduction of passengers, food, and other articles. The conical upper part of the vessel terminates in an open pipe or neck of small diameter. At the base or the neck is a grating having on its top a cap which can be raised or lowered. By raising this cap, a flag may be passed through the top of the vessel, and by means of a double action pump, air can be pumped in and water pumped out. If necessary the air can be admitted to, and made to circulate through, the vessel by means of pipes entering into the vessel near its top, and descending along the inner sides of the vessel to its lower part, the same pipes opening below the seats of the passengers. The upper external ends of the air pipes are turned down some distance on the outside of the conical part of the vessel. The door is also furnished with a grating for the admission of air, such grating forming the side of a flat box inserted in the door. Air enters the flat box by means of a hole in its front, any water passing in with the air escaping by a series of short pipes near the lower edge of the box. A similar arrangement may be employed at the outer end of each air tube for the purpose of securing a supply of air from which water or spray has been separated. In using the apparatus persons, property, and provisions are introduced by the door, which is fastened from the inside. On the sinking of the ship, the apparatus floats, and from its construction rights itself in whatever position it may be thrown, by the action of the waves or other causes. Or the apparatus containing its charge may be lowered from the side of the ship into the water The inventor states that when desired, he can use a cutwater and also means of steering and propelling.

The inventor and patentee of this invention is Mr Thomas George Tolson, of Birmingham.

SKINNER'S RAILWAY ACCIDENT PREVENTER.

THIS is an invention well worthy the attention of railway authorities, for, as far as we can form a judgment from descriptions and models, its use would materially lessen the number of railway casualties. In his final specification just filed, Mr Skinner thus describes his invention My invention consists of certain arrangements of wires, rods, levers, catches, bars, and inclined planes, whereby I obtain a better mode of communication than any hitherto adopted, whether as fog, distance, or danger signals, and for this purpose I make a certain arrangement of wires, rods, levers, catches, bars, and inclined planes which can be actuated by either station porter or other official at any railway station where a train may be stopping or otherwise, and, if required, I can cause certain moveable parts of my invention to be actuated by hydraulic pressure, my object being to enable officials at any railway station, at any distance, to turn on the steam whistle of any engine approaching the station; and also to enable the officials, if they deem it necessary, to shut off the steam of any engine approaching the station; and I also use certain inclined planes which are fixed outside or inside the line of rails—which inclined planes can be made permanent, if necessary, so that they are beyond the tampering of any official connected with the line. I also have attached to the engine a pendant, which can be actuated by the aforesaid inclined planes so that it may be used for shutting off the steam or blowing the engine whistle, as may be required, to give the engine-driver notice of his position when approaching the station or any other part of the line.

For the fog or distance signal, I use certain inclined planes which I fix near to, or on the side of, the line at given distances from the station or other pre-determined part. On the engine I fix a certain shaped lever or pendant, the lower end of which is made to suit the curve of the incline. The upper end of this lever or pendant has a rod or wire connected with the steam whistle. As the engine passes the incline the lower end of the lever or pendant is brought in contact with the aforesaid incline, thereby giving motion to the upper end of the said lever or pendant, which causes the steam whistle on the engine to sound.

When used as a danger signal a similarly shaped incline is fixed on the opposite side of the line, which incline is made to rise and fall by a communication from the station or other point on the railway, that the train is approaching. This is effected by means of a wire or rod which is attached to a lever at the railway station or other point. When these danger signals are required to be worked at a great distance from a station or point on the line, hydraulic power will be necessary in order to enable a station-master or other official to stop a train as it is approaching, for which purpose he will have to pull a lever which at once causes the aforesaid incline to rise The lever, or pendant, is attached to the engine, as before described, and its upper end is connected to the steam shut-off. This lever, or pendant, as the engine approaches comes in contact with the aforesaid incline, when the steam is at once shut off.

HOUGH'S SHIPS' LIFE BOATS.

THIS promising invention, some description of which we recently gave, and intend to further describe and give an illustration of, is attracting considerable attention. Mr. E. Hough, of 15, Tower hill, is the inventor.

CARMICHAEL'S ANTI-WAVE MOTION SHIPS.

THE objects of this invention are to so construct ships and vessels that the prejudicial effects of the waves thereon shall be quelled, so that persons travelling in them shall not be liable to sea-sickness, and, further, that such vessels shall be improved as regards the propulsion of them. The inventor constructs the vessel with a sloping roof, or part of one rising from the surface of the water, or near it, on which the waves may gradually lose their force, as on the slope of a breakwater, instead of rushing against perpendicular sides, and sometimes sweeping the deck. He also provides a clear passage above that roof for the more furious waves to pass from windward to leeward, with a small deck above that open space. The inventor also uses a cylindrical tube, or tubes, extending from stem to stern within the vessel, from one to eight or more feet in diameter, according to the size of the vessel, within, or immediately behind which the screw propeller may rotate. To lessen the friction of the water the inside of the tube should be quite smooth, and the fore-part about a tenth narrower than the stern part. By adopting this arrangement the inventor says the water reaches the screw or propeller directly instead of obliquely, and the stern may thus be made broader than usual in screw-vessels, and should it be found that the screw or propeller can work with advantage within the tube it will then be free from storms and torpedoes, and it is likely that so much power will not be lost by the slip of the screw. The pitch should

be small, and the diameter nearly as broad as the tube. A grating is to be used at the bow to prevent solid substances passing therein. The heavier parts of the vessel are to be on the outside, and moveable weights for balancing are to be provided. But the details of these arrangements can be varied to suit the requirements of the case. Sometimes the inventor uses the following modification. He constructs the greater part of the sloping roof or bulwark in the form of moveable panels to be pushed on in rough weather, so as to cover the open space over the ordinary deck, same to be moveable only when the force of the waves is nearly expended, which may be at about 8 or 10 feet above the surface of the sea. The bulwark at the prow the inventor considers should be permanently fixed, and he proposes to term his ship the *Breakwater* steamer, the action of his improvements being that of a breakwater. In the specification of his patent various other improvements in subsidiary details are described, and the invention is illustrated by appropriate drawings which accompany that document.

The inventor and patentee is Dr. W S. Carmichael, of Annandale-street, Edinburgh, whose name will be familiar to our readers as an occasional contributor of interesting matter to this journal.

MODERN LOCOMOTIVES.

Mr. John Robinson, M. Inst. C. E., of Manchester, read the following paper at the meeting of the Institution of Civil Engineers, 11th November instant. He first stated that, in the present day, with a view to lessen the capital expenditure on railways, engineers had been compelled to follow more closely the contour of the country, both as regarded the vertical profile and the general direction of valleys and hills, the consequence being severe gradients, often concurring with curves of small radius. This fact, taken in conjunction with the circumstance that, in the colonies and in less developed districts, high speeds and frequent communication were not necessary, had led to the employment of heavy engines for the purpose of gaining great tractive power, since load rather than speed was the desideratum. A like state of things existed in most parts of the continent of Europe, where heavy and slow trains, both of passengers and goods, were the rule; thus permitting the service to be carried on at a much lower rate per ton per mile than the rapid traffic of Great Britain rendered possible. Of late years the passenger traffic had so increased in the United Kingdom, that even express trains were now worked, for the most part, with coupled engines, the additional points of contact with the rails being imperative, in order to prevent slipping, and to afford greater facility in starting. Increase in the size of engines had everywhere been found to be a necessity; and while the outside frames of inside cylinder engines had been generally abandoned, the inside cylinder arrangement had been almost universally adopted, notwithstanding the disadvantage it presented of a cranked driving axle. The details of construction of different types of engines, and their adaptation to the work required, were then described. Attention was first directed to the Great Northern Railway express engine, in which outside cylinders had been resumed, perhaps as a necessary consequence of the adoption of a bogie frame with four wheels, instead of a pair of leading wheels, to ensure greater freedom in passing round curves at high speeds. The cylinders were 18 inches in diameter, with a length of stroke of 28 inches—a size, it was believed, never before attempted for passenger engines in this country. The small ends of the connecting rods were furnished with solid bushes of gun metal, and had run more than 50,000 miles without renewal. The inner and the outer fire-boxes were connected together by stays, screwed into each of the plates without the intervention of iron girder bars. By this arrangement, which had been in use for some time in Belgium, the large amount of deposit generally existing upon girder boxes was prevented, the facility for cleansing was much greater, and the liability of the tube holes in the copper plate to become oval had been got rid of. The heating surface in this engine was, in the tubes 1,043, and in the fire-box 122 square feet. The fire-grate had an area of 17.6 square feet. When the engine was in working order, the weights upon the driving and hind wheels, and upon the bogie, were 15, 8, and 15 tons respectively. The distance from the centre of the hind wheels to the centre of the bogie pin was 19 feet 5 inches. This engine was capable of drawing a weight of 350 tons on a level at a speed of 45 miles an hour, with a working pressure of 140 lbs. to the square inch. The consumption of coal, with trains averaging sixteen carriages of 10 tons weight each, had been 27lbs. per mile, including getting-up steam and piloting. The cost of maintaining and renewing passenger engines on the Great Northern Railway was estimated to amount to 2½d. per mile. The next example selected was the London and North-Western Railway fast passenger engine. In this case the cylinders were inside between the frames, in the smoke-box in fact, and had a diameter of 17 inches, with a length of stroke of 24 inches. The boiler was fed by two Giffard injectors, placed vertically behind the fire-box. The admission of water to the injector was regulated by a screw with a wheel handle. The water ascended and passed through a clack box (that could be closed at pleasure) into the boiler, along an internal pipe, carried forward two-thirds of the length of the barrel of the boiler. All external pipes running forward outside the boiler were thus done away with, and greater simplicity and freedom from accidents were secured. The heating surface in this engine was 1,013 square feet in the tubes and 89 square feet in the fire-box. The area of the fire-grate was 15 square feet. The distribution of weight on the wheels, when the engine was in working order, was 9 tons 9 cwt., 11 tons, and 8 tons 15 cwt. on the leading, driving, and trailing axles respectively. The total wheel base was 15 feet 8 inches. This engine could draw a load of 293 tons on a level at a speed of 45 miles an hour, with a working pressure of 120 lbs. to the square inch. The consumption of coal per mile was 26·3 lbs., with trains averaging ten carriages, and the cost of repairs, over a period of six years and a half, had been 0·52 of a penny per mile run. The six-wheeled coupled goods engine made for the Great Southern and Western Railway of Ireland, and consequently suited to a gauge of 5 feet 3 inches, was next described. In this case the cylinders were 17 inches in diameter, with a length of stroke of 24 inches. The tires of the wheels and the axles were of cast steel. The coupling-rod ends were furnished with cast-iron bushes, lined with white metal. The small ends of the connecting rods had wrought-iron steps, case-hardened. Sand boxes were fixed in the smoke box, and a steam break was applied. The heating surface in the tubes was 846 and in the fire-box 93 square feet. The fire grate had an area of 17½ square feet. The weights upon the leading, driving, and trailing wheels were 10 tons 12 cwt., 11 tons 7 cwt., and 8 tons 15 cwt. respectively. The total wheel base was 15 feet 6 inches. This engine could draw a load of 607 tons on a level at a speed of 25 miles an hour, with a working pressure of 140 lbs. to the square inch. The average consumption of coal was 35 lbs. per mile with a load of fifty-five waggons. The cost of repairs had been 0·63d. per mile. The next engine referred to had been specially designed for the heavy goods traffic on the Bombay, Baroda and Central India Railway, where the gauge—5 feet 6 inches—had afforded great facilities for the construction of a powerful machine on a reasonable length of wheel base. The cylinders were 18 inches in diameter, with a stroke of 24 inches. The escape of smoke, when the engine was standing still, was prevented by the application of Mr. D. K. Clark's apparatus, for the introduction of air above the surface of the fire. There were 1,278 square feet of heating surface in the tubes and 99 square feet in the fire-box. The area of the fire-grate was 25¼ square feet. This engine could draw a load of 694 tons on a level at a speed of 25 miles an hour, with a working pressure of 140 lbs. The consumption of coal was 59¼ lbs. per mile for an average load of 490 tons. The cost of repairs had been 3·22d. per mile. A peculiar feature of this engine was the position of the hind axle under the fire-box, permitted by the shallowness of the end of the latter. This arrangement answered the double purpose of allowing a comparatively short wheel base and an equal distribution of the weight of the engine upon the wheels,—11 tons, 11 tons 16 cwt., and 11 tons 16 cwt, being carried on the leading, the trailing, and the driving wheels respectively. The locomotive next described was of the class usually called "tank engine," and was constructed for the conveyance of mineral or heavy goods traffic over a portion of the Furness railways, having gradients of 1 in 100, 1 in 80, &c., for 11 miles. This engine was designed to obtain as much power as was possible upon six wheels. The frames had been put inside the wheels, to allow convenient access to the motive parts, the cylinders being placed inside, to secure a great structural stability. The cylinders were 18 inches diameter, with a stroke of 44 inches. Tanks, to contain 1 000 gallons of water, were arranged along each side of the smoke-box, the boiler, and the fire-box, above the level of the frame, so as to distribute equal weights upon the wheels, which, when the engine was in working order, and the tanks were full, were 13 tons 16 cwt., 14 tons 11 cwt., and 13 tons 8 cwt., on the leading, driving, and trailing wheels respectively. The total wheel base was 15 feet. The heating surface in the tubes was 1041, and in the fire-box 96 square feet. The area of the fire-grate was 15 square feet. The engine could draw a weight of 872 tons on a level at a speed of 20 miles an hour, and a weight of 367 tons up the incline of 1 in 80 at a speed of 11½ miles an hour, with a working pressure of 145 lbs. to the square inch. The consumption of fuel with this latter load had been 40·16 lbs. per mile. For engines with rigid frames, a simple and convenient arrangement had recently been applied, in the shape of a sliding top to the leading, and sometimes to the trailing, axle-boxes. This cap had a double incline in the transverse direction of the engine. The axle-box had also similar corresponding inclines, so that when passing round a curve the leading wheels were free to move sideways, without at once carrying the engine with them. This plan had been largely adopted on the Midland Railway. Details were then furnished of the Fairlie system of locomotives, designed with the object of giving extreme freedom of movement to the engine and wheels, while securing sufficient stability to the boilers and their adjuncts. It had likewise been sought to utilise the whole weight of the fuel and water for the purpose of tractive adhesion. In conclusion, the author alluded to the great advantages which had accrued to the users of locomotive engines, by the adoption of steel instead of iron for many parts, especially for tires and axles, whether the latter were cranked or straight. It was announced that the discussion, which had been commenced, would be resumed at the next meeting of the society.

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Chairman of the Council: SIR ANTONIO BRADY.

NOTICES.—SESSION 1873-4.

THURSDAY, DEC 11TH.—On "Prevention of Railway Accidents by Automatic Railway Couplings." By W. GADD, Esq., C.E., at 8 p.m.

TO MEMBERS OF COUNCIL.

Council meeting to take place at 7 p.m. on same evening.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

At the first members' meeting, held at 4, St. Martin's-place, Trafalgar-square, Mr. HUME WILLIAMS, Barrister-at-Law, Vice-Chairman of the Council, in the unavoidable absence of Sir ANTONIO BRADY, Chairman, presided, and delivered the opening address of the Session 1873-4, which is given as the first article of the present number of this journal.

Upon the conclusion of the address, the Secretary (Mr. CAMPIN) stated that the following business had been arranged for, namely, on 27th Nov., E. R. Southby, Esq., on Economic Gas Cooking Apparatus; 11th Dec., W. Gadd, Esq., C E., on the Prevention of Railway Accidents, by the use of improved railway couplings. After Christmas conferences on the Patent Laws would be held, the precise date of which would be stated in the journal (SCIENTIFIC AND LITERARY REVIEW).

Several remarks were then made by the following members: Mr. F. H. VARLEY (Chairman of Ordinary Council or Executive of the Institute), Mr. TOOTH, Mr. MACCOMBER, Mr. DAVIS, Mr. COOMBE, and had reference to the Vienna Congress on Compulsory Licenses, which they objected to, unless restricted to cases where the patentee failed to supply the public demand. At the conclusion of this discussion a vote of thanks to Mr. Williams, the Chairman of the evening, was passed by acclamation.

At the Council meeting (special and ordinary) preceding the above members' meeting—Mr. H. WILLIAMS, Vice-Chairman of the Council, in the chair—after the minutes of the last meeting had been read and confirmed as being correctly entered—no question having been raised on the resolutions passed by intervening ordinary Councils—the Secretary reported that the question of the position to be taken by the Institute with regard to the Society for the Promotion of Scientific Industry at Manchester had to be dealt with, and that the last ordinary Council had recommended a conference to be solicited; but it had been thought that before taking any action the opinion of the full (special) Council should be taken; thereupon it was resolved that such a conference is desirable.

The CHAIRMAN introduced the question of the desirability of the Institute instituting the award of a medal for a meritorious invention, which was generally acquiesced in, but the subject was considered worthy of further consideration, and was ordered to stand over for further discussion.

The usual communication from the Treasury Committee was made, and several gentlemen admitted as members—were ordered to be placed on the list of members—and Mr. Cromwell Varley was especially proposed and elected a member.

Monthly Notices.

Obituary.—We have to perform the melancholy duty of recording the death of Mr. J. J. Russell, well-known in connection with improved tube making.—Also the decease of Robert John Le Mesurier M'Clure, the discover of a North-West Passage, who was born in 1807, and entered the navy at an early age, serving as a mate on board H.M.S. *Terror*, under Sir George Back, when that veteran Arctic explorer attempted to reach Repulse Bay. M'Clure was then promoted to the rank of lieutenant, and was on the Canadian lakes during the rebellion of 1838. While on this service he performed an act of audacious gallantry, which involved a violation of United States territory. From 1842 to 1846 he commanded the Romney receiving ship at the Havanna, and during 1847 he was in the Coast Guard. When an expedition in search of Sir John Franklin, in 1848, was determined on, M'Clure saw a field for his adventurous spirit, and volunteered for the service. He was appointed first lieutenant of H.M.S. *Enterprise*, under Sir James Ross; and passed the winter of 1848-49 at Port Leopold, returning in the autumn of the latter year. It was at once determined to re-equip the vessels, in order to resume the search for Franklin's missing ships by way of Behring Strait. Captain Collinson was appointed to the *Enterprise*, as senior officer, and M'Clure, who had been promoted to the rank of commander during his absence, took command of the *Investigator*. The story of M'Clure's memorable voyage has been well told by Admiral Sherard Osborn, in a work "Discovery of a North-West Passage." It was on the morning of October 26th, 1850, that Robert M'Clure, standing on a lofty hill on Bank's Land, sighted Barrow Strait and the coast of Melville Island beyond, and thus became the discoverer of the North-West Passage. All doubt as to the existence of a water communication between the two great oceans was removed. The hill was called "Mount Observation." The next year M'Clure performed, probably, the most wonderful feat of ice navigation on record, passing round the south and west sides of Bank's Land, between the shore and the stupendous ice-fields of that inland sea, until he reached the bay of God's Mercy, on the northern coast. The two winters passed in this cheerless spot well-nigh exhausted the provisions, and M'Clure had made all his preparations for abandoning the ship, when, on the 6th of April, 1852, a party from the *Resolute* came to his relief. The comparatively short march from the Bay of Mercy to the *Resolute's* position off Melville Island completed the North-West passage, and M'Clure and his "Investigators" are the only men who have ever passed from ocean to ocean round the northern side of North America. Sir Robert M'Clure afterwards did excellent service during the China war. The funeral took place at Kensal Green cemetery on the 25th Oct., when many brother Arctic explorers assembled round his grave.—Dr. F. Crace Calvert, F.R.S., well known for his various chemical investigations, and whose name is especially connected with the Carbolic Acid manufacture, died on the 24th of October, at Clayton Vale House, near Manchester.

L'Institut prints a very valuable memoir, by M. Walthère Spring, read on the 5th of July last, before the Académie Royale de Belgique, "Composés Oxygénés du Soufre." Also another chemical paper, by Prof. Théodore Swartz, of the University of Ghent, on the "Acides Pyro-citriques." Both these memoirs are important additions to our chemical knowledge.

Ship's Movements.—A series of methodical observations on the various movements of a ship affected by waves was carried out, says the *Times*, on board the ship *Norfolk*, during her last voyage from Melbourne to London. These observations appear to have been made with self-registering instruments, devised by Mr. Spencer Deverell, of Portland, Victoria, who is known to have devoted much time and study to the investigation of the movements of ocean waves, and to their action upon floating bodies.

Lithium in Plants.—From some recent observations by Herr Focke, it appears that lithium is essential to the nutrition of certain plants, such as several species of Thalictrum. The presence of lithium in many plants had previously been recognized, but it was considered to be an unessential element in their constitution.

Post-Glacial Drifts in Ireland.—A sketch of the palæontology of the post-glacial drifts of Ireland has been given in the *Geological Magazine*, by Mr. A. Bell, who has for some time past been engaged in studying the upper tertiary and post-tertiary fossils of the British Isles.

Cultivation of Cinchonas.—According to the *Pharmaceutical Journal*, the cultivation of the cinchona plant is being successfully prosecuted in Java. Considering the great value and the prevailing scarcity of quinine, any attempt to extend the cultivation of cinchonas should be watched with general interest. The barks from the Java plantations are said to yield a high per centage of alkaloids, and thus promise to become a valuable source of the drug.

Interesting Balloon Discoveries.—Some meteorological observations during a balloon ascent have recently been made by M. G. Tissandier. One of the interesting features of the voyage lies in the observations made by the aeronauts on the existence of two atmospheric currents at different altitudes, moving in different directions, and with different velocities. Whilst the lower current was moving at the rate of only six or seven kilomètres per hour, the upper current was found to have a velocity of thirty-five kilomètres per hour.

New Planet.—The last new planet, discovered by Dr. Luther at Bilk, near Düsseldorf, on September 27, has received the name Sophrosyne. The planetary discoveries of that astronomer have been almost continuous since 1852, when he discovered Thetis on April 17.

HOOPER'S TELEGRAPH CABLE SHIP.

THE *Hooper* is the first vessel ever built specially for the purpose of laying cables, and the success which has attended her first voyage fully justifies the anticipations of those by whom she was designed. She is a very large vessel—the largest, after the *Great Eastern* ever built—being over 5,000 tons register. Three enormous cable tanks form a part of her structural design, and therefore, instead of being a source of weakness, as in all vessels merely adapted for this peculiar work, they add considerably to its strength; while their capacity is said to be 5,000 cubic feet in excess of the superstructural tanks of the *Great Eastern*. She is 320 feet long between perpendiculars, 56 feet beam, with 35 feet depth of hold, and a model of admirable construction, and of the application of every scientific labour-saving appliance; while her paying-out and picking-up machinery, being of the very latest construction, embodies every improvement that the most recent experience in deep-sea telegraphy has suggested. The *Hooper* is remarkable in another respect, for, though the second largest in point of size ever built, she is, perhaps, unique for the rapidity with which she was turned out of the builder's hands. In six months from the time of her keel being laid, she was delivered to her owners, and was taking in the first section of a cable which is to connect all the Brazilian ports north with the West Indies, and south with the River Plate. Starting from Plymouth on the 22nd of June last, she went out and laid 1,400 knots of cable between Pernambuco and Para, and was back again in the Millwall Docks on the 4th of October. She has now almost completed taking in a second instalment of 1,600 knots, which will be laid from Pernambuco to Bahia and Rio Janeiro. The vessel will start early next week, and, if all goes well, will complete her task before the close of the year. To celebrate the successful completion of the first portion of her work, a number of the directors and friends of the Hooper Telegraph and of the Western and Brazilian Telegraph Companies met recently on board, and, after inspecting the good ship and the works close adjoining, from which the cable is paid directly into the tanks, lunched together, under the presidency of Mr. Hooper, the managing director of the former body.

Proceedings of Societies.

THE INSTITUTION OF CIVIL ENGINEERS.

The subjects for papers in the Session 1873-74 comprise the following list; and others are invited on such questions as—Account of the Progress of any Work in Civil Engineering, as far as absolutely executed (Smeaton's Narrative of the Building of the Eddystone Lighthouse may be taken as an example); Descriptions of distinct classes of Engines and Machines of various kinds; Practical Essays on Subjects allied to Engineering, as for instance, Metallurgy; and Particulars of Experiments and Observations connected with Engineering Science and Practice.

The following is an abbreviated list:—1. Application of Graphic Methods in the Solution of Engineering Problems, and in the Reduction of Experimental Observations; 2. Elasticity, or Resistance to Deflection, of Masonry, Brickwork, and Concrete; 3. Use of Concrete, or Beton, in large masses, for Harbour Works and for Monolithic Structures; 4. Manufacture of Iron and Steel as now practised; 5. Results of Experience in the recent Extended Use of Steel in Mechanism and in works of Engineering; 6. Theory and Practical Design of Retaining Walls; 7. Modern Methods of Constructing the Foundations of Bridges, and on Bridges of Large Span; 8. On the different Systems of Swing, Lifting, and other Opening Bridges; 9. Lock Gates; 10. Rock-boring and Blasting; 11. Signaling on Railways; 12. Constant Service of Water Supply, with special reference to its introduction into the Metropolis, in substitution for the Intermittent System, and on the waste of Water, and the best apparatus for its prevention; 13. Modes of Dealing with Sewage; 14. Separate System of Sewering Towns; 15. Ventilation of Sewers; 16. Relative Value of Upland and Tidal Waters in maintaining rivers, estuaries, and harbours; 17. Construction of Sluices, 18. Maintenance, by Sluicing, of the Harbours on the Coast of France, Belgium, and Holland; 19. Sea Works at the mouths of the Rivers Adour and Maas; 20. Recent Improvements in the Construction of Steam Boilers adapted for very High Pressures, 21. Best practical Use of Steam in Steam Engines, and on the effects of the various modes of producing Condensation, 22. Construction of Marine Engines; 23. Modern Locomotive Engines; 24. Application of Steam as a Motive Power for Pumping Water or Sewage; 25. Pumps employed for Raising Water or Sewage, and their relative efficiency; and on the employment of Water as a Motive Power for pumping, by means of Water Wheels, Turbines, Water-Pressure Engines, or other machines; 26. Employment of Steam power in Agriculture; 27. Methods of transmitting Force to distant points, and on the Details of the existing systems of Rope transmission; 28. Present State of Science in regard to the Manufacture of Gas for Illumination; and on the Materials most suitable for the purpose; 29. Manufacture of Mineral Oils, and the Lamps best adapted for their consumption in dwellings and lighthouses; 30. "Output" of Coal in the United Kingdom, as compared with that of other countries, illustrated by statistical tables, plans, and diagrams, showing where Coal is produced, and where and how it is consumed; 31. Mechanical Apparatus at present in use in "getting" Coal; 32. Modifications necessary in future Coal Mining Operations; 33. On Turf, or Peat, Cutting, Macerating, and Pressing Machinery, with experiments as to its heating power and expense as a Fuel, as compared with Coal; 34. Methods of Draining distant isolated sections of Mines; 35. Compressed Air as a Motive Power for Machinery in Mines, with some account of its application on the Continent; 36. Use of Diving Apparatus in mines, especially in Westphalia and in Germany.

For approved Original Communications, the Council state they will be prepared to award the Premiums arising out of special Funds devoted for the purpose.

Papers which have been read at the Meetings of other Societies, or have been published in any form, cannot be read at a Meeting of the Institution, nor be admitted to competition for the Premiums.

The communications must be forwarded, on or before the 31st of January, 1874, to the house of the Institution, No. 25, Great George-street, Westminster, S.W., where any further information may be obtained. The notification is signed by Charles Manby, *Honorary Secretary*, and James Forrest, *Secretary*.

The following premiums were awarded during the Session of 1872—73:—1. A Watt Medal, and a Telford Premium, in Books, to Sir Charles Augustus Hartley, M. Inst. C.E., for his Paper on "The Delta of the Danube, and the Provisional Works executed at the Sulina Mouth;" 2. A Telford Medal and a Telford Premium, in Books, to James Deas, M. Inst. C.E., for his Memoir on "The River Clyde;" 3. A Watt Medal, and a Telford Premium, in Books, to John Head, Assoc. Inst. C.E., for his Paper on "The rise and progress of Steam Locomotion on Common Roads;" 4. A Watt Medal, and a Telford Premium, in Books, to William Anderson, M. Inst. C.E., for his Description of "The Aba-el-Wakf Sugar Factory, Upper Egypt;" 5. A Telford Medal, and a Telford Premium, in Books, to William Thomas Thornton, C.B., for his Essay on "The relative advantages of the 5 feet 6 inches Gauge and of the Metre Gauge for State Railways of India;" 6. A Telford Medal, and a Telford Premium, in Books, to Colonel William Henry Greathed, C.B., R.E., for his "Account of the practice and results of Irrigation in Northern India;" 7. A Telford Premium, in Books, to John Milroy, Assoc. Inst. C.E., for his Paper on "Cylindrical or Columnar Foundations in Concrete, Brickwork and Stonework;" 8. A Telford Premium, in Books, to William Pole, LL.D., F.R.S., M. Inst. C.E., for his "Notes on the Rigi Railway;" 9. The Manby Premium, in Books, to Thomas Sopwith, Jun., M. Inst C.E., for his Paper on "The Mont Cenis Tunnel."

The Council have likewise awarded the following Prizes to Students of the Institution:—1. A Miller Prize to Frank Salter, B. Sc., Stud. Inst. C.E., for his Paper on "Economy in the use of Steam;" 2. A Miller Prize to John Newman, Stud. Inst. C.E., for his Paper on "The Calculations and Investigations necessary in designing Iron Cylinder Bridge Piers;" 3. A Miller Prize to Alfred Fyson, Stud. Inst. C.E., for his Paper on "The English Standard Gauge *versus* Narrow Gauges for Railways;" 4. A Miller Prize to Joseph Prime Maxwell, Stud. Inst. C.E., for his "Notes on Railway Curves;" 5. A Miller Prize to Killingworth William Hedges, Stud. Inst. C.E., for his Description of "The Denver and Rio Grande Narrow Gauge Railway;" 6. A Miller Prize to Nathaniel St. Bernard Beardmore, Stud. Inst. C.E., for his Account of "The Reconstruction of King's Weir on the River Lee;" 7. A Miller Prize to Osbert Henry Howarth, Stud. Inst. C.E., for his Essay on "The Rationale of Permanent Way;" 8. A Miller Prize to Charles Graham Smith, Stud. Inst. C.E., for his Paper on "Mortar."

Nov. 11.—Mr. Hawksley, President, in the chair.—A Report was brought up from the Council, recommending the election into the corporation of two members and thirty associates, and stating that the following candidates had been admitted as students of the Institution:—Messrs. W. Y. Armstrong, W. P. Castelbadie, H. T. Crook, J. G. Cruikshank, W. B. Dawson, T. Edwards, M. P.

Elliot, W. T. Foxles, W. B. Godfrey, J. Hunter, H. D. Johnston, L. Lloyd, H. E. MacMahon, M. M. Minas, J. J. Mullaly, T. O'Hagan, H. C. Perram, G. B. Reynolds, C. S. Rolfe, A. Ward, and N Watts.—The paper read (which is given in another column) was "On the Design and Construction of Modern Locomotive Engines," by Mr. J. Robinson.

MICROSCOPICAL SOCIETY.

November 5th.—C. Brooke, Esq., President, in the chair. A paper, by the Rev. W. H. Dallinger was read, describing some further researches made by himself and Dr. Drysdale on the development of certain Monads, in the course of which they had been able to trace the life-history of a species, although in their earliest stages these organisms were so minute as to require an objective of one-fiftieth of an inch for their observation. A number of drawings accompanied the paper. Mr. A. Sanders read a paper "On the Art of Photographing Microscopic Objects," in which he described a simple and successful process of manipulation, and showed how the most satisfactory results might be obtained without the aid of expensive and complicated apparatus: full details were given as to printing, toning, and enlarging, as well as obtaining the negatives. A short discussion followed, in which Mr. Wenham, Dr. Matthews, the President, and Mr. Sanders, took part. A paper was also read, by Mr. S. J. M'Intire, entitled, "Some Notes on Acarellus," in which he minutely described a species found parasitic upon obisium, and which he believed to be identical with hypopus, described by Dujardin. The characteristics of another species were also detailed, and drawings in illustration of the paper were laid upon the table. Specimens, both mounted and alive, were exhibited under microscopes in the room. Some photographs of Navicula and *Amphipleura pellucida*, taken by Dr. J. J. Woodward, with a magnifying power of 1,380 diameters, were also exhibited to the meeting.

CHEMICAL SOCIETY.

Nov. 6.—Dr. Odling, President, in the chair. The President delivered a short address, congratulating the Fellows on taking possession of their new rooms in Burlington House.—A paper was read, by Mr. D. Howard, "On the Optical Properties of some Modifications of the Cinchona Alkaloids," being an elaborate investigation of the variations in the rotatory powers of this class of bodies when examined by the polarimeter.—The other communications were, "A Preliminary Notice of the Oils of Wormwood and Citronella," by Mr. C. R. A. Wright,—"On the Estimation of Nitrates in Potable Waters," by Mr. W. F. Donkin, —and a "Note on the Action of Iodine Trichloride upon Carbon Disulphide," by Mr. J. B. Hannay.

ANTHROPOLOGICAL INSTITUTE.

Nov. 11.—Professor Busk, President, in the chair.—Mr. P. A. Scratchley and Dr. D. Johnson were elected members.—Mr. T. J. Hutchinson read a paper "On Explorations amongst Ancient Burial-grounds, chiefly on the Sea-coast Valleys of Peru." The Huacas or burial-grounds described in the paper were those on the coast-valleys between Arica and the Huatica Valley, close to Lima. The results of the author's examinations of the Pacha-Camac inclined him to the belief that there were no evidences of either a temple of the Sun or a house of the Virgins there, as no proof exists, in spite of contrary statements, that the Incas ever occupied those valleys after they are said to have conquered the country. The colossal burial-mounds called Huacas in the Huatica Valley were depicted in the diagrams exhibited, as well as their dimensions, furnished from the trackings of Mr. Squier, a North American gentleman, who accompanied and assisted the author in his explorations. The strange peculiarity of those pre-historic earth-mounds arose from the fact of their terraces all approximating in their proportions to multiples of twelve.—Mr. F. Galton read a communication "On a Method of collecting Anthropological Statistics from Universities, Schools, Factories, and other large Bodies of Children and Adults"—Dr. Simms exhibited a flattened skull, found in Mameluke Island, Columbia River, and described in detail the practice of flattening the head in infancy among the native Americans.

GEOGRAPHICAL SOCIETY.

Nov. 3.—Sir Bartle Frere in the chair.—The President opened his address by referring to the expected attendance on that occasion of Sir Samuel Baker, prevented by illness, and read a letter from Sir Samuel, written before his illness. It was hoped that Sir Samuel would be able to attend on the 8th of December. The President passed in review the proceedings of the Geographical Section of the British Association's last meeting, and then touched upon the geographical discoveries brought to light during the recess.—Mr. Markham, the Secretary, read a paper "On the Discoveries of the Polaris," upon which there was a short discussion, and it was urged that, if the Government would not send out further expeditions, a voluntary effort should be made in this direction. Admiral Sherard Osborn opposed this view.

ROYAL INSTITUTION.

Nov. 3.—Geo Busk, Esq., Treasurer, in the chair.—The Secretary announced the decease of Sir Henry Holland, the President, on October the 27th.—H. A. Focking, Esq., and Major J. A Wood were elected members. The special thanks of the members were given to C Woodward, Esq, for his present of his work on the "Polarisation of Light," and of much valuable apparatus illustrating the subject; and also to W. Salmon, Esq, for his donation of £10 for the promotion of scientific research in the Royal Institution.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

November 4th.—Sir Henry Rawlinson, Vice-President, in the chair. The following candidates were nominated for election:—Rev. Prof. Campbell (Montreal); Rev. Dr. Douglas (Glasgow); Capt. E. Dumergue; Prof. T. Hayter Lewis, F.R.I.B.A.; Albert J. Mott, Alexander Peckover, F.R.G.S.

The following papers were then read:—

1. On Fragments of an Inscription giving part of the Chronology from which the Canon of Berosus was copied. By Geo. Smith. Mr. Smith commenced by describing the fragments of the tablet, which he believed to belong to the seventh century B.C. He then gave an account of the kings on the new tablet, and some others recently discovered. These monarchs included several belonging to the mythical period, and others of the historical. Among these were Zabu, who founded the temples of Sippara, Mili-sihu, and Merodach Baladan I., his son, who reigned in the fourteenth century B.C.; Simmas-sihu and his six successors, who reigned in the eleventh century B.C. The positions of the various monarchs and their reigns were discussed, and attention was drawn to the short average of the reigns in the best preserved fragment, seven kings only occupying forty-nine years and three months.

2. On a New Fragment of the Assyrian Canon belonging to the Reign of Tiglath-Pileser and Shalmaneser. By Geo. Smith. —The account of a fragment of the Assyrian historical canon followed.—This belongs to an important epoch about which there has hitherto been very little information, the period from B.C. 732 to 722, including the reign of Shalmaneser IV. The new fragment shows that there was no break or irregularity in the succession of the Assyrian eponymes at this period, and proves the accession of Shalmaneser to have been B.C. 727, a fact previously doubted by some scholars. The bearing of the new fragment on various Biblical dates and statements was gone into, the author being of opinion that this fragment, in conjunction with some other Assyrian inscriptions, tended to materially confirm the Biblical chronology.

The following gentlemen took part in the discussion:—Dr. Birch, M. Julius Oppert, Rev. A. H. Sayce, Geo. Groove.

VICTORIA INSTITUTE.

Meetings are to be held on Monday, December 1st, 1873, at which the following papers will be read:—"The Identity of Reason in Science and Religion." By the Rev. R. Mitchell. Monday, January 5th, 1874.—"Magnitudes in Creation and their bearings on Biblical Interpretation." By the Rev. J. H. Titcomb, M.A.

ZOOLOGICAL SOCIETY OF LONDON.

November 4th, 1873.—Professor Newton, F.R.S, Vice-President, in the chair. The Secretary read a report on the addition that had been made to the society's menagerie during the months of June, July, August and September, 1873, and called particular attention to two Argus pheasants (*Argus giganteus*) from Malacca, presented by Sir Harry Ord, C.B., Governor of the Straits Settlements, and a pair of Cingalese jungle-fowls (*Gallus stanleyi*), presented by Henry Bayley, Esq. Mr. G. Dawson Rowley, F.Z.S., exhibited a singular malformed variety of the domestic duck, and the Secretary a collection of fishes (containing six examples of *Ceratodus forsteri*) made by Mr. Ramsay, C.M.Z.S., in Queensland. An extract was read from a letter received from Mr R. B. N. Walker, C.M.Z.S., addressed to Dr J. E. Gray, F.R.S., and communicated by him to the society, respecting Mr. Walker's endeavours to obtain living gorillas for the society's collection. A communication was read from Mr. J. B. Perrin, containing an account of the Myology of the Hoatzin (*Opisthocomus cristatus*). A communication was read from Capt. R. Beavan, Bengal Staff Corps, C.M.Z.S., containing a list of fishes met with in the River Nerbudda, in India. A second communication from Capt. Beavan contained some remarks on certain difficulties involved in the acceptance of the Darwinian theory of evolution. A communication was read from Mr. Montague R. Butler containing descriptions of several new species of diurnal Lepidoptera. A communication was read from Mr. R. Swinhoe, H.B.M. Consul at Chefoo, on the Song-Jay of Northern China, with further notes on Chinese ornithology. Mr. P. L. Sclater, F.R.S., exhibited and pointed out the characters of 14 new species of birds collected by Signor Luigi Maria D'Albertis during his recent expedition into the interior of New Guinea. A communication was read from Professor J. V. Barboza du Bocage, F.M.Z.S., on the Ground Hornbill of Southern Africa—*Bucorvus caruncalatus cafer* of Schlegel. A second communication from Professor Barboza du Bocage contained a note on the habitat of *Euprepes coctei*, Dum. et Bibr. A communication was read from Surgeon-Major Francis Day, F.Z.S., containing descriptions of new or little known Indian fishes. Mr. R. B. Sharpe, F.Z.S., read a paper describing the contents of a collection of birds recently received from Mombas in Eastern Africa. A second paper by Mr R. B. Sharpe contained a list of a collection of birds from the River Congo. Mr. G. B. Sowerby, jun., communicated the descriptions of eleven new species of shells. A communication was read from Dr. J. E. Gray, F.R.S., on the skulls and alveolar surfaces of land tortoises—Testudinata.

November 18th, 1873.—Dr. A. Günther,

F.R.S., Vice-President, in the chair. Mr. Slater exhibited and pointed out the characters of new species of birds obtained by Mr. Salmon during his recent expedition to the State of Antioquia, Columbia. These were *Chlorochrysa nitidissima* and *Grallaria ruficeps*. A letter was read from Mr. R. Swinhoe, H.B.M. Consul at Chefoo, containing a note on the white stork of China, and stating that he had recently obtained a live *Pitta* in China, which appeared to be *Pitta nympha* of the Fauna Japonica. Mr. A. H. Garrod exhibited and pointed out certain peculiarities in the cæcum of a crab-eating fox (*Canis cancrivorus*). Mr. J. E. Harting, F.Z.S., exhibited and made remarks on a curious variety of the common partridge shot in Northumberland. Mr. Sclater exhibited and made remarks on a pair of horns of the new Bubaline antelope from the Bogos country, lately named *Alcelaphus tora* by Dr. Gray. A communication was read from Dr J. E. Gray, F.R.S., containing a paper by Dr. Edward L. Moss, surgeon in charge R. N. Hospital, Esquimalt, on a singular Virgularian Actinozoon taken at Burrard's Inlet, close to the Northern Mouth of the Frazer River. A communication was read from Dr O. Finsch, C.M.Z.S. containing the description of a most remarkable and interesting new Passerine Bird which he had received from Mr. T. Klinesmith of Levuka, Ovalou, Feejee Islands. This little bird which was not only new as a species, but also the type of a new genus, he proposed to call *Lamprolia Victoriæ*. A communication was read from Mr. W. S. Atkinson, of Darjeeling, containing the descriptions of two new species of butterflies from the Andaman Islands, which were named respectively *Papilio mayo* and *Euplœa andamanensis*. Dr. Cobbold communicated the first of a series of papers entitled "Notes on the Entoza," being observations based of the examination of rare or otherwise valuable specimens contributed at intervals by Messrs Charles Darwin, Robert Swinhoe, Charles W. Devis, the late Dr. W. C. Peachy, Dr Murie, and others. Mr. Edwin Ward, F.Z.S., exhibited and gave the description of a new bird of Paradise, of the genus *Epimachus*, which he proposed to call *E. ellioti*. A communication was read from Surgeon-Major Francis Day, F.Z.S., containing remarks on Indian fishes, mostly copied from the original manuscripts of the late Dr Hamilton Buchanan. Mr. J. W. Clark, F.Z.S., read a memoir on the eared seals of the Auckland Islands, one of which he recognized as *Otaria hookeri*, thus fixing the locality of this species.

The next meeting of the society for scientific business will be held at the society's house, Hanover square, on Tuesday, the 2nd of December, 1873, at half-past eight o'clock, p.m., when the following communications will be made:—1.—Dr. James Hector, C.M.Z.S.—On *Cnemiornis calcitrans*, showing its affinity to the Natatores. (Received 16th October, 1873.) 2.—Mr. W. H. Hudson.—On the habits of the Pipit of the Argentine Republic. (Received 15th September, 1873.) 3.—Mr. A. G. Butler.—Revision of the genus *Protogonius*. (Received 24th October, 1873.)

STATISTICAL SOCIETY.

NOVEMBER 18.—Dr. W. A. Guy, President, in the chair.—Among the candidates elected were the Baroness Burdett-Coutts, the Earl of Roseberry, Lord Lawrence, Sir W. Jones, Bart., Sir H. L. Anderson, and others, in all thirty two.—The evening was occupied with the Inaugural Address of the President.

MATHEMATICAL SOCIETY.

NOVEMBER 13.—Prof. Cayley, and subsequently Mr. J. J. Sylvester, in the chair.—Mr. Sylvester and Lord Rayleigh were elected to the Council, in the place of the retiring Members, Prof. Crofton and Mr. Stirling.—Mr. Sylvester gave an account of a new instrument for converting circular into general rectilinear motion, and into motion in conics and higher plane curves.—Mr. W. Adams exhibited and explained the mode of operation of his Mensurator and Coolometer, and gave a brief account of the objects to which they could be applied.—Mr. S. Roberts read a short note "On the Expression of the Arc of a Cartesian by Elliptic Functions." The purport of the note was that the hyper-elliptic part of the integral which gives the value of an arc of a Cartesian is reducible to the form which Jacobi has shown to depend on elliptic functions.

A HORRIBLE INVENTION.—In a recent number of that instructive and pleasant journal *The Antiquary* a correspondent (H. Fraser) writes:—"I have in my scrap-book an engraving of a diabolical machine, entitled the 'Jungfern Kuss,' or Virgin's Kiss. It is of metal, shaped outwardly like the figure of a woman in an ancient costume of about the fifteenth or sixteenth century, with a matronly-looking face. The front of the machine opens outwardly, disclosing a number of blades or spikes, on a level with the face and breast, and at the bottom is a circular plate. I have lost the description of the machine; but to the best of my recollection, it stated that the original had been purchased by an antiquary (whose name was not given), from a person who had obtained it, by means which would not bear investigation, from the arsenal of Nuremberg. The description went on to say that the machine was used for putting persons to death, by thrusting them inside and closing the front, when two of the blades pierced their eyes and several others the breast, and the circular plate beneath their feet opened and let them through into the apartment beneath, in which was placed a machine consisting of six revolving cylinders, studded with sharp blades, on which the body fell, and which cut it to pieces, the spaces between the cylinders being graduated so that the lowest pair were the closest, and the fragments of mortality then dropped into a running stream which passed through the dungeon. I should be glad to hear whether this horrible machine is still in existence, and if so, in whose possession it now remains, also who was the inventor."

An important work on the mineral resources of Italy is in course of publication. Under the title of "I Tesori Sotterranei dell' Italia," the Chevalier Jervis, of the Royal Industrial Museum at Turin, is writing a full description of the mineral-bearing localities throughout the kingdom. The first of three volumes has just appeared, and contains a description of the Alpine Region of Italy, the next volume will describe the Apennine Region; and the third will take in the Italian Islands.

The first organization of an international service in France, for the application of the electric telegraph to the concentration of meteorological observations, was made by M. Le Verrier, in 1855. *Les Mondes*, of October 16, informs us that, on the 15th the Observatory of Paris was put in daily relation with seventy-five meteorological stations, spread over the whole of Europe (including Greenwich, Scilly, Scarborough, and Yarmouth in the British Isles), and with several places in Africa. The *Bulletin International*, published by the Observatory, will give regularly for each day the observed pressures and temperatures, the direction and force of the wind, and all other observed meteorological observations from each station.

Whether the modern chemical formulæ should or should not be introduced into mineralogy is discussed by Von Kobell in an interesting paper published by the Bavarian Academy of Sciences, and reproduced in *Poggendorff's Annalen*.

Correspondence.

TIDAL ENGINES.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—The following is the substance of a communication by me to the Section of General Physics of the British Association, September, 1873:—

THE DIRECT UTILISATION OF WATER POWER, AND OF TIDAL FORCE.

It may be assumed that for all practical scientific purposes, the ancient water wheel, or the more modern adaptation of the screw hydraulic engine, effects the most perfect economical utilisation of any given gravitation of water which can produce mechanical action only in a direct basis of the height of the fall, and the quantity of water available as a motive force.

The writer of this memoir would, therefore, only suggest the possibly convenient application of the scheme which he now proposes to any ordinary water friction, or precipitated head of water. The object of his invention being more peculiarly with reference to the useful employment of tidal force—a naturally existent energy or powerful mechanical agency which men, to this late period of the world's historical annals and wonderful accumulation of scientific discovery, have allowed to run to waste, and without any practical employment by the enterprising industries of the universe.

An immense natural force is hidden and unemployed in this perpetually acting motive power, equal to a constantly acting dead weight or gravitating force of 287,000,000 tons upon the general shore line of Great Britain.

The mode in which the author of this memoir would propose to employ a portion of this natural force—or provident gift of nature—would be by conducting the tidal waters by pipes in suitable localities to an engine placed at half tide level.

This engine would be of the simplest mechanical device, any number of cylinders receiving the injection, which latter would propel a piston in each, to drive by ordinary process any required motive arrangement.

Slide valves working upon the lower convexity of the cylinders would at the end of each stroke open for the free discharge by gravity of the expended volume of water, which would be introduced alternately upon each side of the piston, as in the ordinary steam engine. An air pump attached to the engine might be found to aid in the free relief of the expended volume of water. The water thus discharged would be made to run into the reservoirs formed below the level of the engine itself, and these reservoirs would discharge themselves on the efflux of the tide, and be again ready for use from each staff to full and half ebb, or for six hours constant work in every twelve hours.

The force obtained in this engine would be cumulative, averaging in these six hours of work, upon a tide of 10 feet, 2½ lbs. on the square inch of piston, with a cylinder of 3 feet diameter and stroke of 6 feet, upon a surface of piston of 1,036 square inches, giving a force of 2,592 lbs., or one ton and one-sixth, at a speed of 45 strokes per minute, furnishing with one such cylinder an engine of 23-horse power, or with a cylinder of 6-feet diameter, stroke 6 feet, and 45 strokes per minute, an engine of 87-horse power.

The 3 feet cylinder would discharge in 6 hours' work 709,640 cubic feet of water, requiring a reservoir of large capacity to contain it until the last hours of the ebb tide, when it would empty itself by means of culverts or syphon pipes into the adjacent estuary. 12 syphons or culverts of 3 feet diameter would clear the reservoir of its contents in half an hour at low tide.

The necessity for so large a waste reservoir, at a depth equivalent to the whole rise of the tide, would confine the employment of such an engine to localities where such excavations could be conveniently and economically contrived.

This effluent water could, however, be again made use of in working the engine during the recess of the tide, by simply conducting a discharge syphon through the cylinder.

The 3 hours of first-flow might also similarly be utilised by constructing a second auxiliary reservoir below the level of low water. The emptying of this second waste reservoir would be effected by means of a pumping apparatus, worked by the engine itself, or by a water-wheel fixed in the discharge of culverts, which operation would neutralise the force temporarily obtained in the 3 hours of first flood; but the advantage would thus be achieved of the uninterrupted and continuous working of the tidal engine, which is now proposed. A constant unintermittent power might also be maintained by a very simple compensatory process.

It should be remarked that the dimensions and hypothetical details of the proposed engine are assumed merely for the purpose of more clear exposition, and are not altogether such as would be adopted practically; as, for instance, in speaking of a single-cylinder in place of the ordinary combined system, &c.

It may finally be remarked that, with a 3 foot cylinder, working at half-power, the retardment would be one-half, giving 23 strokes per minute, equal to 11-horse power, discharging 12,880 cubic yards of water in the 6 hours, and requiring a reservoir of 130 yards by 100 by 3 feet deep, or 65 by 50 and 6 feet deep.

A double-cylinder engine of 3 feet diameter as above would work to 23-horse power, and would require a waste-water reservoir of 260 yards by 100 and 3 feet deep.

J. Napier.

Salisbury, Nov. 3rd, 1873.

PHRENOLOGY.

To the Editor of the Scientific and Literary Review.

Sir,—With reference to Mr. A. L. Vago's note in your journal of the 1st ult., so long ago as the year 1825, the late Mr. Thomas Wakley boldly advocated the truth of this science as it was taught by Dr. Gall and Dr. Spurzheim, as may be seen by reference to the *Lancet* for that year, and subsequently. In the *Zoist*, for thirteen years, 1843-55, the late Dr. Elliotson, and other medical men, elucidated the truth of this valuable science. I could produce at least 100 certificates published by notable physicians, surgeons, &c., in favour of this science, and which were collected by the late Mr. George Combe. The "Twenty-five years Ago," of the *Times* writer, of the 24th September, only takes us back to the year 1848, twenty years after Mr. Combe published his "Constitution of Man." But, long before 1828, the objections of Dr. J. Gordon, Lord Jeffery, and of other critics, had been demolished by Mr. G. Combe. It is useless for any journal to contend, successfully, against such evidence as Mr. C. Combe produced in favour of the science, which the Government ought to support. I am convinced that it is most valuable with reference to lunatics and criminals. See the testimony in favour of the science, published in "Combe's Phrenology," vol. 2.

I am, Sir, yours obediently,

Chas. Cooke.

London, Nov., 1873.

Durham Cathedral.—In addition to the several stained glass windows which have already been inserted in the Nine Altars and south transept of Durham Cathedral, it is understood that the Freemasons of that city are about to place a window in the Nine Altars in memory of Mr. John Fawcett. Major Joicey and the Dean are also about to add stained windows to the south aisle, whilst other persons are also mentioned as being probable contributors to similar desirable improvements and additions to the many architectural and other attractions of the cathedral.

Historical Portraits.—At a recent sale at Clapton House, near Stratford, many pictures possessing considerable historic interest were disposed of. Among the portraits was the original painting of George Carew, Earl Totneys, famous for his dealings with the Spaniards during Elizabeth's reign. There was also a fine portrait of Shakespeare, who was a frequent visitor at Clapton House, and one of the mother of Oliver Cromwell reading her Bible. The other portraits were a half-length of James II, by Lely; William III, by Kneller; General Ireton, two of Queen Elizabeth, Henry IV., and a full-length of Arabella Stuart. Mr. Graves, of Pall-mall, was the principal purchaser.

An Ancient Greek Manuscript.—Mr John Strachey Hare has placed in the hands of Professor Newman the facsimile of a Greek MS., purchased in Egypt by Mr. Arden, of Rickmansworth Park. It consists of forty-eight narrow columns, equivalent to sixteen closely-printed octavo pages. Professor Newman has translated the whole into English, and although some of the columns are mutilated, and particularly in places of interest, nevertheless, one gets a pretty complete understanding of the whole. It contains two Attic orations, by a contemporary of Alexander the Great. The Greek is excellent, and very easy.

Ancient American Civilization.—All through their country are ruins of great fortresses, towers, aqueducts, and other public works, the origin of which is unknown to the present Indians, or only vaguely known by tradition. Some of these houses contained from one hundred to one hundred and sixty rooms. In Pecos the ruins of a Christian Church and a temple to Montezuma stand side by side—the pagan temple being apparently the oldest of the two—just as the two religions may have for a time flourished alongside of each other. According to Indian tradition, it was built by Montezuma himself, who charged them not to lose heart under the foreign yoke, and never to let the sacred fire burn out in the *estufa*, for "when the time should come in which the tree should fall, men with pale faces would pour in from the east and overthrow their oppressors, and he himself would return to build up his kingdom, the earth would become fertile, and the mountains yield abundance of silver and gold." How the Spaniards came and conquered them is, according to them, a partial fulfilment of Montezuma's prophecy; and how the Americans with the pale faces came in their turn and drove out the Mexicans, may be taken as a second part of the fulfilment; the third they are still waiting for. The Pimas themselves state that at one time they used to live in large houses, and were a great and powerful nation; but after the destruction of their kingdom they travelled southward, and settled in the valley where they now live, preferring to live in huts, so that they might not become a subject of envy for a future enemy.—"Cassell's Book of the Races of Mankind."

Experiments have been conducted by Prof. Jacobi, of St. Petersburg, with the view of determining whether the electro-deposition of iron is affected by powerful magnetic influences. Accordingly solutions of the double sulphate of iron and magnesia were reduced in two vessels, side by side, and placed under similar conditions, except that one of them was surrounded by an electro-magnetic spiral. After the experiment had continued for a month it was found that the same weight of iron was reduced in each vessel. The iron, in both cases, was deposited in the form of a tube on a cylindrical core, but in the vessel surrounded by the solenoid the particles of iron were curiously aggregated towards the two ends of the tube.

"Annales de Chimie et de Physique" for November, contains the results of the comparative observations which M. Marchand has regularly recorded for several years, on variations in the actinism or chemical force of sunlight. As a sensitive agent, he employs a mixture of a solution of oxalic acid and perchloride of iron.

M. Berthelot continues his valuable researches on different forms of natural and artificial carbon. He has now examined the carbon found in the meteorite from Cranbourne, near Melbourne; the carbon from certain rocks of reputed meteoric origin in Greenland; a large number of samples representing different varieties of natural graphite; and carbon artificially deposited from carbonic oxide by the action of iron.

M. de Saint-Florent writes to the "Bulletin de la Société Française de Photographie," that by a new process, he has obtained heliochromic proofs whose colours have the closest relation with the natural colours. Landscapes have also been obtained, but the colours were faint. His processes are published in the journal named, No. 9, for 1873.

Mr. William Crookes has, at the request of Sir William Muir, of the Army Medical Department, drawn up a "Memorandum on the Purification of Drinking Water, with special reference to that which is likely to be met with on the Gold Coast."

Some interesting experiments on Prince Rupert's Drops have been made by M. Victor de Luynes. Instead of inducing the rupture of the glass by mechanical means, he subjects the drop to the slow solvent action of hydrofluoric acid. The solution proceeds quietly, whether the inflated end or the delicate tail be acted on, until a certain point is reached, at the origin of the neck, when the remainder of the drop suddenly becomes disintegrated.

APPLICATIONS FOR LETTERS PATENT.

(*Continued from page 186.*)

On September 4th.—2906 to 2917.—*G. Leggett.* School furniture, parts of which improvements are applicable to other purposes.—*J. A. Forrest* and *W. Hayes.* Waterclosets.—*E. Worrall.* Apparatus for withdrawing water from pipes heated by steam, and arrangements in connection therewith.—*V. Driver.* Apparatus for cleaning and polishing table cutlery.—*M. Tardioli.* Sowing machine, termed "Tardioli's mechanical drill."—*G. Haseltine.* Machine for burnishing photographic pictures (com.)—*E. G. Brewer.* Improvements in or connected with calenders used in the manufacture of paper (com.)—*W. Brenton.* Reaping machines.—*E. Davies* and *T. J. Walker.* Apparatus for heating the feed-water of steam boilers.—*R. Stone.* Construction of arches, bridges, floors, ceilings, and other like structures, also the construction of walls, and other like erections.—*D. Brown.* Apparatus for stoppering bottles.—*F. H. Holmes.* Fog signals, suitable for lighthouses and lightships.

On September 5th.—2918 to 2928.—*G. F. Neville.* Method or process of manufacturing or fabricating leather, and of bleaching, dyeing, and staining the same.—*C. Anderson.* Means and apparatus for propelling tramway cars.—*J. J. Perry.* Stoppers for bottles and other articles.—*J. Noad.* Construction and manufacture of fire-lighters, and improved machinery to be employed therein.—*J. Tyrer.* Buckles for fastenings for braces, belts, and bands.—*W. Hodson.* Machinery for the manufacture of bricks, tiles,

and other analogous articles.—F. Wilkinson. Improvements in ascertaining and indicating the work done by machinery used in preparing, spinning, doubling, and weaving cotton and other fibrous materials, and apparatus connected therewith.—T. B. Hitchman. Sewing machines.—S. Simmons. Manufacture of hats, and similar coverings for the head.—T. Fardon. Expansion gear for steam and other engines.—F. Sénéchal. Dress and figure improvers.

On September 6th.—2929 to 2943.—W. F. Gedge. Machine for cleaning and winnowing grain and seed (com).—A. Hobson and W. C. Williams. Velocipede.—N. Macphail. Mode and means of and apparatus for registering and checking the number of payments made by passengers in tramway and other public carriages or omnibuses.—J. H. Johnson. Reversible flock-cutting machines (com.) (Complete specification.)—W. MacLean. Printing, lithographing, or zincographing on textile fabrics.—T. Flitcroft. Carding engines.—L. Bourget. Propelling vessels, and apparatus to be used therefor.—L. Bois, his Manufacture of lighting gas, and apparatus employed therein.—J. R. T. Mulholland. Hackling machines.—A. T. Rousseau and C. H. Stevens. Melodions or American organs.—J. McGregor. Improvements in mechanism or apparatus to be employed for glazing and polishing saws and other similar articles having flat metallic surfaces.—W. A. Gilbee. Hydraulic motive machine or engine (com.)—P. Charpentier. Apparatus for heating furnaces. (Complete specification.)—W. Single. Apparatus for locking railway switches.—G. Haseltine. Valves for steam engines (com.)

On September 8th.—2944 to 2955.—W. Hunt. Apparatus for the manufacture of sulphate of soda and sulphate of potash.—H. Rogers. Cut nails. (com.)—A. C. Henderson. Sewing machines for working two needles either simultaneously or independently, and moveable shuttle carriages in connection therewith (com.)—R. Hatch. Improvements in the construction of pickers used in looms for weaving.—H. A. Bonneville. Self-acting machinery for sowing potatoes (com.)—F. Byart. Apparatus for cutting after weaving the velvets and other fabrics which are woven face to face.—G. Grange. Improvements in the use of paper substituted for cardboard in jacquard machines.—R. Boyd. Improvements applicable to furnaces or fire-places for the generation of heat by the combustion of fuel (com.)—W. E. Lilly. Box or case for holding reels, bobbins, or other devices containing thread, ribbon, cord, braid, and other fabrics.—H. L. Newton. Blast furnaces (com.)—A. F. Wilson. Manufacture of gas.—T. Newton. Military and other saddles.

On September 9th.—2956 to 2964.—L. Fr[illegible]. Electric battery (com.)—E. P. Jones. Brakes for railway carriages and waggons.—J. Lanham. Manufacture of boots and shoes.—R. Dobbie and P. Forbes. Damper or throttle valve chamber, or flue for stoves.—H. P. Newton. Blast furnaces (com.)—J. Higgins. Machinery for spinning and doubling cotton and other fibrous materials.—W. E. Newton. Steam boilers and condensers (com.)—A. M. Clark. Diamond-cutting machines (com.)—W. Smith, younger. Machinery for breaking stones, ores, sugar, bones, or other hard or brittle substances. (Complete specification.)

On September 10th.—2965 to 2978.—H. Archer. Protection for hind legs of horses from injury, consisting of saving boot made of leather, with laced sides with elastic one to be worn on each hind leg.—H. A. Bonneville. Regulator or governor for adjusting the speed or rotary motion of steam engines (com). (Complete specification.)—A. Hinder. Reaping and mowing machines.—G. Mohr. Manufacture of metal deed and other boxes, travelling trunks, portmanteaus, and similar articles.—W. Moseley. Electrical signal apparatus.—T. L. Phipps. Clippers for clipping horses and other animals, and for other like purposes, and instruments or apparatus for sharpening the teeth or cutters of clippers.—H. Holland. Manufacture of gas for illuminating and heating purposes.—C. Jurgenson. Weeding and seed-gathering machine (com.)—E. S. Robinson. Machinery for the manufacture of satchell or rectangular bottomed paper bags (com.)—D. O. Edwards. Means and apparatus for producing and radiating heat.—J. H. Johnson. Rotary engines (com.)—W. B. Brain. Electric fuses for discharging dynamite, lithofracteur, and other blasting bodies or compounds.—H. E. Newton. Feed-water indicator for steam boilers (com.)—W. E. Newton. Construction of superstructure and foundation of bridges (com.)

On September 11th.—2979 to 2995.—J. L. Whitmarsh. Book rests for invalids.—J. Gedge. Clip, or instrument for clipping or shearing animals (com.)—J. A. Dixon. Process for treating copper pyrites, copper blendes, and other sulphuretted copper ores which contain iron (com.)—J. H. Johnson. Mechanical puddling of iron and apparatus or means employed therein, also regenerative furnaces to be used therefore, and for other purposes where gaseous fuel is applicable (com.)—W. Calvert. Sliver cans.—W. B. Brain. Combinations of ingredients for producing explosives for blasting and mining purposes.—A. Johnson. Sewing machines.—T. Smedley. Sheathing or protecting iron and steel ships or vessels from corrosion and from the adhesion thereto of animal and other matter.—N. D. Spartali. Propellers, and the mode of applying the same to the propulsion of floating vessels.—T. A. Edison. Perforated paper for telegraphic purposes, and means for receiving and transmitting with the same.—C. G. Harston. Breech-loading firearms.—J. W. Martin. Pistons.—F. Wirth. Circulating lubricators for journal boxes and bearings of quickly revolving shafts, spindles, and also for revolving pulleys and similar objects (com.)—F. Wirth. Coupling for railway waggons (com.)—A. M. Clark. Endless railway or travelling street sidewalks, partly applicable for coupling other railway carriages (com.)—A. Clark. Screw valves (com.)—W. Jones. Apparatus for propelling and steering ships and other vessels.

On September 13th.—2996 to 3004.—J. J. Perry. Mechanical toy (com.)—S. Mason and M. Alcock. Kiers employed in the bleaching, scouring, or treatment of woven fabrics, yarns, and other materials or substances.—E. G. Phillips. Fire-lighters.—J. Grimshaw. Coating for rendering nails, washers, bolts, nuts and other similar articles anti-corrosive.—P. Kingston. Shaping and joining strips of cane or wood for cricket bat handles or other purposes.—C. J. Everlicks. Folding or portable chairs, seats, and other analogous articles.—W. E. Newton. Bridges (com.)—G. B. Boomer. Screw press.—C. Winn. Gas lamps.

On September 13th.—3005 to 3014.—W. A. McVaon. Apparatus used in the manufacture of gas.—C. W. Toner. Water waste preventers for waterclosets, urinals, washing, and other apparatus.—T. Hyatt. Windmills (com.)—H. Alder. Beds, hammocks, mattresses and seats of sofas, couches, chairs, and other similar articles.—P. Baker. Apparatus for stopping the bung, vent, and tap holes in casks, and for stopping mouths or orifices of jars, bottles, flasks, and other similar vessels.—H. M. Richardson. Jacquard apparatus employed in looms for weaving.—G. W. Richardson. Means or apparatus for ventilating and pumping purposes.—W. R. Lake. Adjustable brackets for use in dental operations, supporting reading and writing desks, and the like, and for other similar purposes (com.)—E. T. Hughes. Manufacture of the salts, carbonates, and hydrates of baryta and strontia, and also for improved modes of making baryta and strontia caustic (com.)—E. T. Hughes. Treatment of the liquors used in scouring or cleaning wool (com.)

On September 15th.—3015 to 3028.—T. Shakespear and G. Illston. Sewing machines.—F. T. Sutton. Construction of cases for containing clocks or other apparatus having dials (com.)—W. Walker. Apparatus for regulating and controlling the temperature of liquids and fluids.—E. Marsden. Improvements in and applicable to pans for boiling down, reducing, or concentrating liquids, parts of which improvements are applicable for condensing or refecting liquids whilst pruning and boiling over.—J. Dodd. Mules for spinning and doubling cotton, wool, and other fibrous materials.—C. H. Wetzel. Reservoir penholders, and means of preserving a supply of ink therefrom (com.)—A. Turner. Sewing machines (com.)—T. Smith. Apparatus employed in concrete building.—T. A. Weston. Apparatus for transmitting, regulating, and arresting motion in machinery.—J. N. Paxman. Feed-water heater, applicable also for other purposes.—H. Greener. Manufacture of decanters and ornamental glass bottles and jugs.—J. Woods. Apparatus for embroidering.—H. Cook. Means or apparatus for supporting boilers (com.)—F. D. Mott. Rotary engines.

On September 16th.—3029 to 3046.—J. Edwards. Locks and striking plates for the same.—G. J. Ball. Machinery and apparatus for breaking and crushing stone or other hard substances.—W. P. Francis and F. Addiscott. Manufacturing coffeetina.—D. J. Kennelly. "Getting" and treatment of peat for the manufacture of fuel, the utilising of waste heat for drying the peat, also the obtaining of distillatory products therefrom, and the machinery, apparatus, or means employed therein.—J. Bell. Washing machine (com.)—J. Owen. Steam boilers.—J. Roberts. Brakes for broughams, phaetons, waggonettes, dog carts, and other two and four wheeled vehicles.—G. F. Cornelius. Compound or mixture to be used for lubricating purposes, and for grinding and reducing white lead and colours.—T. Jones. Rendering wood uninflammable, applicable to building and other purposes.—G. I. Bousfield. Apparatus for obtaining motive power from the rise and fall of the tide.—E. Bagot. Manufacture of tin and terne plates, and the apparatus employed therein.—J. Whitchcord. Construction of fire-proof buildings.—R. H. Cowins. Switch locking apparatus.—C. Peters. Horse collars.—A. Turner. Manufacture of india-rubber hose and tubing, and the preservation of india-rubber, gutta percha, and rubber fabrics (com.)—T. Fuchy. Ornamentation of articles formed from gold.—J. Gedge. Machine or apparatus for varnishing sheets of tin, and for other purposes (com.)—E. A. Bourry. Steam boilers.

On September 17th.—3047 to 3056.—G. Haseltine. Machinery for opening, cleaning, scutching, and lapping cotton and other fibrous materials (com.)—W. Schroiber and P. Passavant. Apparatus for the manufacture of corks.—W. Whiston. Dying and printing silk fabrics.—J. W. Connon. Seat and desk for use in schools and other places.—J. H. Johnson. Machines for heckling hemp, flax, and other similar fibrous substances (com.)—J. H. Johnson. Operating the valves of steam engines (com.)—H. Gardner. Mode of and apparatus for ventilating furnaces (com.)—J. Toner. Treating or preparing seal tablets.—P. Penn-Gaskell. Weighing scales (com.)—A. W. Gillman and S. Spencer. Manufacture and treatment of beer in order to preserve it, and to restore it when it has become sour.

On September 18th.—3057 to 3073.—J. Rotuier. Life buoy with tractive cable.—C. Chapman. Safety apparatus for saving life and property at sea.—J. H. Johnson. Automatic regulating valves. (com.)—G. Haseltine. Process of tanning hides, skins, or pelts, and cleaning wool and fur (com.) (Complete specification.)—R. Punshon. Anchors for ships.—C. Lucop. Arrangement and construction of steam ships and other floating craft, for mercantile, war, or other purposes.—J. E. F. Aylmer. Apparatus for the manufacture of ground wood pulp.—G. Haseltine. Manufacture of printer's type (com.) (Complete specification.)—E. Cottam. Safes.—J. Rye, A. Rye, H. Rye, and S. Emsley. Machinery or apparatus for twisting wool, cotton, silk, or other fibres before or after spinning.—J. Fielding. Railway brakes and the mode of working them.—J. A. A. Buchholz. Treating corn, rice, and other grain, and apparatus for the purpose.—C. Watts and T. C. Watts. Lubricating axle-box.—W. R. Lake. Manufacture of fertilizing substances and apparatus therefor, and the means for preventing the escape of offensive odours during such manufacture, and from slaughter-houses, rendering tanks and the like (com.)—P. Spence. Treatment of phosphates of iron and alumina for the purpose of obtaining certain useful products therefrom.—A. Lely. Drilling and shaping machines.—A. V. Deshayes. Embroidering machines.

On September 19th.—3074 to 3085.—R. Smith, jun. Machines for decorticating, cleaning, and polishing rice, grains, and seeds.—W. H. Holyoake. Fixing transparencies to lamps, windows, and other articles adapted for the passage of light.—J. B. Stone. Miners' safety lamps.—J. W. Martin. Tube expander and stopper.—S. J. Moore and R. H. Courtenay. Compound motive-power electro-magnet.—W. Scott and A. E. Bruno. Back sight for fire-arms.—C. D. Abel. Blue dye or colouring matter named "Violaceine" (com.)—J. Harrington. Locks or fastenings.—S. [illegible] and A. Proctor. Means [illegible] apparatus for economising the waste heat and [illegible] from boilers and other furnaces, part thereof being useful as a water or liquid heater.—A. Wilkinson. Coating and preserving telegraph wires, ropes, and cables.—W. W. Greener.

Breech-loading guns, rifles, and pistols.—C. N. Ryland. Buckles or clasps for braces, belts, and bands.

On September 20th.—3088 to 3096.—J. Fottrell. Composition for the manufacture of pipes and tubes suitable for water at high pressure, and as conduits for sewage purposes, gas, brine, and other saline liquors.—T. A. Scott. Washing machine and appliances connected therewith.—T. May. Mode of working the slide valves of steam engines.—J. Day and R. P. Walker Draw-plate or blower for cooking ranges.—W B. Smith and J. Starley. Sewing machinery, and tuck markers to be used therewith.—H. Negretti and J. W. Zambra. Thermometers. —H. Deacon. Manufacture of alkali—T. Wood and J. K. Hewitt. Stall fittings for stables.—Dr. E. A. Crane. System for economising the heat of open fire-places in the warming and ventilating of dwelling-houses and other buildings.—J. Gray, Knt. and M.P. Apparatus for damping paper for printing.—J S. Mignot. Manufacture of twilled fabrics for covering umbrellas, sunshades, and parasols.

On September 22nd.—3097 to 3106.—H. Bradwell Manufacture of umbrellas, and the mechanism employed therefor.—J. W. Gray. Machinery for decorticating, cleaning, and polishing rice and other grain and seeds.—D. Grimshaw. Cut-nail machinery.—J. C Mewburn. Construction of buildings, and the manufacture of the stones or materials to be employed therein (com.)—J C. Mewburn. Lighting railway carriages with gas, and apparatus employed therein (com)—J. A. Cumine. Apparatus for exhibiting and magnifying photographs and other pictures or objects.—J M. Croft. Buffers for railway rolling stock and other vehicles running in trains. —W R. Lake. Machinery for rolling steel and iron (com.)—W. Lightwood. Apparatus for making cartridges.—H. Barraud. Treatment of photographic surfaces and pictures.

IMPORTANT INVENTIONS FOR SALE, DISPOSAL, OR LICENCE.

THE ATTENTION OF CAPITALISTS AND MANUFACTURERS

Is solicited to the following list.—

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- Bricks, and Roofing Tiles.
- Bottle Stoppers.
- Couplings, or Joint, for Hose, Water Pipes &c.
- Saucepan Stirrer.
- Machine for Making Brushes.
- Tin Lined Lead Pipes.
- Traps for preventing escape of foul air.
- Diaries and Account Books.
- Life Boats.
- A Covering for Tramway Cars.
- Steam Ploughs, anchors for.
- Sewage Manure.
- Treating Skins and Furs.
- Earth Closets and Water Closets.
- Boilers for Steam Engines.
- Hammock Beds.
- Locks.
- New Musical Instrument.
- Purification of Whiskey and other Spirits.
- Application of Petroleum and other Hydro Carbons as Motive Power.
- Machine-made Wood Pavement.
- Sliding and Revolving Shutters.
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THE

SCIENTIFIC AND LITERARY REVIEW,

AND RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

Journal of the Inventors' Institute.

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THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

Chairman of the Council—SIR ANTONIO BRADY.

THE various efforts which have been made, and the numerous influences now at work to injure, if not to destroy, Patent Rights; the insufficiency of the many well intended, but ill considered, schemes of Patent Law Reform which have from time to time been suggested, and the tendency of which has generally been to prejudice the Inventor, without advantage to the Public, together with the proceedings so essentially involving the interests of inventors which have already taken place in Parliament, show the necessity of an immediate and active co-operation on the part of those interested in Inventions and in Patent Property, and that an Association for the Protection and Defence of Patent Rights is urgently needed. This Institute has, therefore, been established for the purpose of uniting and organising the influence of Inventors, Patentees and others. Its objects are:—

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2nd. To promote improvements in the Patent Laws.

3rd. To facilitate the diffusion of information with reference to Inventions and other subjects beneficial to Inventors and Patentees.

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APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

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Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE.

JANUARY 1, 1874.

REVISION OF THE PARLIAMENTARY REPORT ON PATENTS.

As all men of science and intelligence wish to begin a new year with the hope of improving upon the doings of the last, we think it right to present our readers with what appears to us to be something likely to aid Patent Law Reform, namely, the propositions agreed to by the Sub-Committee of the Inventors' Institute, appointed to consider the Report of the Select Committee of the House of Commons on Letters Patent, which we published ***in extenso*** in our number of 1st February, 1873.

The Sub-Committee of the Institute (hereinafter termed I. I. Com.) consisted of Captn. J. H. Selwyn, R.N., Messrs. Hume-Williams, F. H. Varley, F. W. Campin, A. J. Murray, C. G. Carttar, and the *ex officios*; it held several meetings, at which the following conclusions as to the statements and recommendations of the House of Commons Committee (hereafter referred to as H. C. C. Rep.), were arrived at, viz.:—

To paragraphs 1 and 2, H. C. C. Rep.—No objection.

Paragraph 3, *H. C. C. Rep.*—The *I. I.* committee, entirely dissenting from the conclusions contained in the first sentence, state—that Manufactures depend upon Inventions, not inventions on manufactures. Invention would certainly be more rapid under a well-devised Patent Law, and it is doubtful whether the present law affords either "stimulus" or protection sufficient to encourage the development of the great majority of useful inventions.

Paragraph 4, *H. C. C. Rep.* (which refers to the undesirability of substituting pecuniary rewards for patents).—The *I. I. Com.* not only recognised the truth of this conclusion, but desired to record their unqualified condemnation of the system of public pecuniary rewards, as being unpractical, impolitic, and sure to lead to grave injustice; and *added*—The true reward fairly earned is a per centage on the benefit derived by the community from the invention; however there *may* be, in the absence of such gain so made, in rare instances, a fair claim on the public purse.

On paragraph 5, *H. C. C. Rep.* (which condemns the defective state of the existing Patent Law), the *I. I. Com.* state—The committee emphatically confirm this conclusion, which they gratefully recognise as an instalment of the justice due to the public, to manufacturers, and to inventors.

Paragraph 6, *H. C. Rep.*, the *I. I. Com* accepted only so far as it relates to protection being granted for a limited period, and to date back to the time at which it is applied for, but held that novelty of invention is a fact that can never be decided conclusively by any authority whatever. They also considered that a large number of valuable inventions would be lost to the public were the strict definition of the word "manufacture" to become an absolute limiting condition.

Paragraph 7, *H. C. C. Rep.* (proposing changes in provisional specification) *I. I. Com.* state—It is the opinion of the Committee that no change in the existing practice is necessary; the distinction between "provisional" and "complete" specifications ought to be preserved. No provisional specification should be open to inspection.

On paragraph 8, *H. C. C. Rep.*, as to all patented articles being manufactured in the United Kingdom, so as to supply the demand on reasonable terms. The *I. I. Com.* regarded this as entirely unpractical, many inventions being best carried into effect in other countries where cheaper labour or materials exist. All inventions by their very nature must conflict more or less with existing interests. No definition of "reasonable terms" has ever been attempted.

On paragraph 9, *H. C. C. Rep.* (which relates to the abolition of Patents for foreign inventions, except to the inventor or his representative) the *I. I Com.* state—The introducer of a novel manufacture has, in many cases, been as great a benefactor to the public as the inventor, and in the public interest he should continue to be encouraged. And added—We prefer that the law should remain as it does at present, provided care be taken that the rights of the original inventor shall always be paramount.

On paragraph 10, *H. C. C. Rep.*, *I. I. Com.* state—If any Government dues are considered to be justifiable, which we dispute, we think it will be desirable to apply such dues in the manner which appears to be suggested in this paragraph, and that the Stamp Duties and official fees should be subject to a large reduction, say, at least one half of the present rates.

Paragraph 11, *H. C. C. Rep.*, was agreed to.

Paragraph 12, *I. I. Com.* quite agree that a special tribunal should be constituted for Patent matters; but consider that a well constituted Arbitration Court would be preferable.

On paragraphs 13, 14, 15, *H. C. C. Rep.*, the *I. I. Com.* remark—We agree with the condemnation of the constitution and practical working of the Patent Commission contained in these paragraphs, and we consider that a more efficient and suitable authority ought to be substituted.

On paragraph 16 (*a*) *H. C. C. Rep*, the *I. I. Com.* state—Though we are not averse to such a limited form of preliminary examination as is embodied in the Reports and Inventions Right Bill of the Inventors' Institute, we aver that the defects mentioned in this paragraph (*a* section) work little, if any, practical public injury. Paragraph 16 (*b*). We dispute the fact that there is any such obstruction as would justify legislative interference. Paragraph 16 (*c*). We agree that an intending patentee has very insufficient means placed at his command for ascertaining whether his invention is new. Paragraph 16 (*d*) We emphatically affirm this remark of the Committee. This remark is to the effect that time, trouble, and expense of Patent proceedings are excessive.

The other propositions of the I. I. Com. we must reserve for our next number, but we may now state that a New Patent Committee of the Inventors' Institute has agreed that measures ought to be at once taken to get the cost of Patents reduced to at least one-half of their present prices.

Reviews.

ELECTRIC FORCE OF STEAM.

A Letter to the Secretary of the Smithsonian Institution, Washington, on Electricity as the Expansive Force of Steam, and soliciting an Experimental Investigation of the Theory, and also of an Allied Theory submitted for consideration at the Meetings of the British Association 1840 and 1848, and in various publications. By G. A. ROWELL, Honorary Member of the Ashmolean Society, &c. Printed for private distribution by the Author, 3, Alfred Street, St. Giles's, Oxford, England. 1873.

HERE is a production worthy of the attention of all natural philosophers. By this letter Mr. Rowell makes the following brief statement as to his theory. -

The theory on which the whole is grounded, is, that, as electricity has no weight, occupies space, and coats the surface of all bodies, there must be a point at which any substance (be its specific gravity what it may), if sufficiently minute, would be buoyant in the air if fully enveloped in its normal coating of electricity; that when expanded by heat, the increase of the surface of particles of water giving them a greater capacity for electricity, they are buoyed up into the air by their coating of electricity; that if condensed near the earth's surface, the extra quantity of electricity is withdrawn, and the vapour falls or is attracted to the condensing body and forms dew, &c.; but if it rises out of the electric attraction of the earth, and is then condensed, the electricity being insulated, forms an atmosphere around each particle of vapour, which surcharge of electricity not only suspends the vapour by its lightness, but also repels the neighbouring particles of vapour, and prevents the formation of rain; but on the escape of this surcharge of electricity from the particles of vapour, either from passing over high hills, from the air becoming damp and in a conducting condition, or from any other cause, the particles lose their buoyancy and fall as rain

On the two following subjects the theory has been supported, or in a measure proved, by observations in America,--the theory on the cause of auroræ, advanced by Professor Loomis from phenomena during the great display in 1859, being almost identical with that proposed by myself in 1839 on theory alone; the only difference being that Professor Loomis gives from forty-five to five hundred miles as the limits of the aurora above the surface of the earth; whereas I hold that it is possible auroræ are seldom much above the level of the higher clouds, and often at a lower altitude, and I have shown that the observations of Dalton (*Trans. of the Roy. Soc.*, 1828)—which are so much referred to as proving the aurora to have been over one hundred miles above the earth—only prove that no reliance can be placed on observed altitudes of auroræ, and that each person sees his own aurora, as each sees his own rainbow. The theory, as applied to storms is, that "they generally result from a rarefaction of the air produced by the escape of electricity of vapour, during excessive rain from clouds at a low level; as water, when in a state of vapour in the atmosphere, must occupy the space of an equal weight of air; and as water is eight hundred and sixty times heavier than the air at the sea level, the fall of an inch of rain must produce such a rarefaction in the atmosphere over the whole space of the rainfall, as would result from the abstraction of the air over that space up to seventy feet in height during the time in which the inch of rain falls." This theory is strongly supported by facts brought out since the publication of the American weather maps; as it is at least proved that excessive rains are the cause of storms.

From the first advance of the theory I saw no necessity to deviate from the simple hypothesis (already given) which forms the basis of all that I have advanced, till in 1871, from a calculation suggested by myself, I found that the increase of capacity for electricity from any probable expansion of the particles of water at natural temperatures, would not alone be sufficient to produce the effects I attribute to that cause; yet I hold that the various phenomena referred to in my papers, can only be accounted for in accordance with the theory, that evaporation and the suspension of water in the air result from the particles of water being buoyed up into the air by their coatings of electricity; and I submit, that it is not only possible, but highly probable, that the normal electric coating of all bodies upon the earth is in proportion with their temperature

With this slight change, or addition, I believe the theory will hold good on every point; as, in accordance with it, a particle of water in its most condensed state, when detached from every other particle, might be sufficiently buoyant from its natural coating of electricity to be carried away by any slight current of air; and particles with an increase of temperature, and consequently of electricity, would raise into the air from their increased buoyancy, where from loss of heat they would become surcharged but still supported by their electricity till the escape of the excess of it.

Thus, then, the theory remains the same as when first advanced, more than thirty years ago, except that instead of attributing the ascent of vapour to electricity resulting from an expansion of the surface of the particle, I now assume that it may be from its attraction for electricity by its increase in temperature; and the theory, that the distribution of electricity is thus affected by temperatures, is, I believe, fairly supported by thermo electric phenomena.

With this modification, the theory will more readily apply to the cause of the long suspension of volcanic dust in the atmosphere, and the ascent of smoke to considerable heights in the air, from the minute particles becoming surcharged with electricity by their heated condition when they rise from the earth. And, although foreign to the subject treated of in the papers, I would suggest that the fact that extremely heated molten metal can be handled with impunity, may be accounted for from the powerful attraction of the intensely heated metal for electricity; which, coating the surface, prevents actual contact with it, and opposes a kind of non conducting medium to the heat.

The expansive force of steam may also be accounted for in accordance with this theory, and to this subject I would more especially direct attention. This force is generally attributed to an enormous expansion or some undefined change in the particles of water; but we have no proof that the particles of water can be expanded in any great degree, or that water undergoes any real change beyond the separation of its particles when converted into steam; as even from high-pressure steam the water can be instantaneously reduced to its normal condition by condensation. Scientifically, steam is attributed to the expansive force of caloric; but this is hypothetical, and opposed to the fact that super-heated steam does not scald. I believe the expansion of steam arises from the intense force with which electricity is impelled to, coats, and thus separates the super-heated particles from the heated water. The agency of heat in the generation of steam is not a proof that it is the expanding force, and the connection of electricity with evaporation is obvious. During evaporation electricity is carried off, or, as I believe, is the great agent in producing it. The isolation of water retards evaporation. Applied electricity promotes evaporation. And on the condensation of super-heated steam electricity is enormously produced, as shown from its development by the hydro-electric machine. The fact that the temperature which will boil water (*i.e.*, convert it into steam) depends on the atmospheric pressure, shows that boiling does not arise from any change in the water on its acquiring a certain degree of heat, but may be caused by its temperature reaching that degree at which the pressure of the atmosphere can be overcome, and the most heated particles separated from the mass of water, by the force with which electricity is impelled to the surface of all bodies according to their temperature; when obtaining their full coating of electricity, the particles rise through the superincumbent water as steam. The ordinary boiling point at any one place, varies more than four degrees according to the atmospheric pressure; and on the summit of Mont Blanc the boiling point is 34° (*Fahr.*) below that of the sea level.—Water requires a higher temperature to boil in a glass than in a metal vessel; showing that the boiling of water is affected by the conductive properties of the vessel containing it; and it is well known that water and electricity are produced on the condensation of vapour. Water under pressure can be heated to 400° of temperature or more; the expansive force of the vapour increasing in a like degree by the increasing attraction of the highly heated particles for electricity. The cool and dry condition of high-pressure steam, when it escapes from the boiler, may arise from the still heated particles of water being so completely enveloped in electricity. In vacuo water will boil, *i.e.*, steam will be produced, at a temperature of 72°; this phenomenon is explicable in accordance with the theory now advanced, and is analogous to that of the rapid evaporation of water in vacuo, which I attribute to the particles being buoyed up, one upon another, by their natural electric coatings on the pressure of the air being taken off.

I submit, that on this theory the even temperature of boiling water is fairly explicable, as each particle, on acquiring the necessary degree of heat, would instantly obtain its proportionate coating of electricity and be carried off by it. The non-visibility of steam while under pressure may arise from its then being one body of electricity, the particles of water being few in comparison to the space occupied, and too minute to be visible. The diminution of sensible heat in high-pressure steam on its escape from the boiler, as the heat of the water from which it is generated is raised above that of its ordinary boiling point, I attribute to the super-heated particles of water being completely and densely enveloped in their coating of electricity, and thus kept from actual contact with the bodies on which they impinge. And as somewhat connected with this subject, the fact that a globule of water may lie for a considerable time on extremely hot metal, with but little or no evaporation from it, I attribute to its being brought into a thorough negative or minus condition by the superior attraction of the heated metal for electricity; and thus the particles are deprived of the coating of electricity which would carry them off as vapour.

I respectfully submit for consideration this theory on the cause of the electricity and expansive force of steam; and earnestly solicit that it may be experimentally tested. I do this with much confidence, bearing in mind the importance of the experiments and investigations carried out on an allied subject by the Committee of the Franklin Institute more than forty years ago, and understanding that the nature of the force of super-heated steam is now much under discussion and investigation in America. Then, if successful on this, I may hope for a trial of the experiments which have been leading subjects in my mind for half a century, and proposed in my first, and repeatedly alluded to in subsequent papers, i.e., the raising of electric conductors to the clouds, by means of a balloon, which, I believe, in accordance

with the theory advanced, would withdraw the surcharge of electricity from the vapour, and produce rain; and similar experiments in high northern latitudes might produce an aurora or be effective during the prevalence of one. Such experiments would be costly, and perhaps of no real value beyond giving an insight into the cause of phenomena of the nature of which we have no real knowledge; but, if of sufficient importance, there is no country in which such experiments could be so properly tried as that in which Franklin, by somewhat similar means, proved the identity of lightning and electricity.

NATURAL HISTORY FOR BEGINNERS.

"Outlines of Natural History for Beginners," being Descriptions of a Progressive Series of Zoological Types. By H. Meyne Nicholson, M.D., DSc., &c., Professor. William Blackwood and Sons, Edinburgh and London.

The intention of this admirable little work essays to convey elementary knowledge of natural history in a form suitable to junior scholars.

It has recently been asserted (says Dr. Nicholson) that zoology is not a subject which can profitably be taught in schools. In this opinion the author finds himself entirely unable to concur; and the present work is an attempt to solve, upon a new basis, the problem how the facts of natural history can be imparted to the previously uninstructed beginner in such a manner that he may obtain some real knowledge of the subject, and not a mere parrot-like acquaintance with a greater or less number of technical names.

In this work, no other preliminary knowledge is assumed in the learner than some slight acquaintance with the chief functions of the animal body. Or, it is assumed that the teacher, in the absence of such preliminary knowledge, will explain to the learner the meaning of such terms as "breathing-organs," "circulatory system," or the like, and will point out in what the processes of respiration and circulation really consist.

Instead of reviewing the divisions of the animal kingdoms in a systematic manner, a series of common types has been chosen, representing the various classes of animals, and the leading peculiarities of these types have been described more or less fully. At the close of the description of each type, the characters which it possesses in common with the other members of its class are pointed out; and in a concluding chapter it is shown how the classes may be arranged under larger divisions or "sub-kingdoms."

Two or three classes, as being of very small importance, have been altogether omitted. For obvious reasons, also, the reproductive system and processes of the animals here described have been altogether ignored. For equally obvious reasons, the peculiarities which are connected with *internal* structures have been in many cases passed over in silence, or merely alluded to; whilst attention has been directed to the conspicuous characters which are afforded by external points of structure.

The animals selected as representatives of the various classes are, with few exceptions, common types; and any teacher may readily obtain all of them, or nearly allied forms, for class demonstration, so that all the more important points alluded to can be shown to the learner upon the specimens themselves.

The technical terms employed in the descriptions of the types are exceedingly few in number, and explanations of their meaning have been invariably inserted in the text, along with their derivation, thus rendering a separate glossary unnecessary.

With the exception of the forms here chosen as representatives of the classes of the Pteropoda and Brachiopoda, the author may be permitted to state that he has personally examined and dissected, either in the fresh state or as preserved in alcohol, all the types here selected for description; and that in the cases excepted he has a similar personal acquaintance with forms closely allied to the ones described, whilst the latter have been studied by him as regards their hard parts. Since most of the forms here selected are of common occurrence, and since the author is by profession a teacher of Natural History, he does not state this as being in the smallest degree a fact worthy of praise, or, indeed, of mention at all in an ordinary way, but simply as a guarantee that he is not merely retailing second-hand information. Most of the facts, therefore, recounted in the present work, though by no means original, have been verified by the personal examination of the author; and the descriptions have been drawn from actual specimens.

We shall perhaps best inform our readers as to the way in which Professor Nicholson has fulfilled the task he has undertaken by stating that amongst the list of illustrative wood cuts contained in the book, which are clearly described in the text, are:- Section of one of the arms of a star-fish (Uraster rubens), anatomy of a wheel-animalcule, the anterior sucker of the medicinal leech and one of the jaws, structure of the integumentary skeleton of the lobster, internal anatomy of the lobster, anatomy of an insect, the common whelk (*Buccinum undatum*) and the tongue of the whelk, skeleton of the common frog, skull of the rattlesnake, head of the rattlesnake dissected to show the poison-gland, the grey lag goose, head of the grey lag goose, foot of the domestic goose, skull of the sheep dog, and skeleton of the dog. We think Professor Nicholson has done good service to the cause of real education for the people, if regarded, as we maintain it should be, as a system of acquiring knowledge of things around us, rather than (though not wholly exclusive of) mere book lore or scholastic learning. And although the Professor has been so modest as to term his work a school book, we can safely say that it would profit many who have long left school to attentively peruse it for the sake of obtaining some general scientific acquaintance with the animal world around them.

THE NATURALIST ON THE AMAZONS.

"The Naturalist on the River Amazon." A Record of Adventures, Habits of Animals, Sketches of Brazilian and Indian Life, and Aspects of Nature under the Equator during eleven years of travel. By Henry Walter Bates, F.L.S. (Assistant - Secretary, Royal Geographical Society). Third Edition, with numerous illustrations. London: John Murray, Albemarle-street.

Now that the time for New Year's Gifts has arrived, the issue from the press of a new edition of this pleasant and valuable work is exceedingly opportune, for no book could be better fitted for presentation to any young person, and for the matter of that to any old one either. To those of our readers who may not have made acquaintance with the two former editions of this work, we may say that it is not a scientific account in a dry way of naturalistic objects brought under the observation of the author during his rambles. He fully describes his adventures, and gives graphic accounts of places he has visited and their inhabitants. Amongst these places are Pará, the Tocatins, and Cameta Caripi, and the Bay of Marajo. The Lower Amazons—Olydos, Manaos, Santarem, the Tapojos, Ega, on the Upper Amazons, and beyond it.

As a specimen of the contents of this book, we present the following:—

My assistant, Jose, in the last year of our residence at Ega "regatou" (ransomed, the euphemism in use for purchased) two Indian children, a boy and a girl, through a Japura trader. The boy was about twelve years of age, and of an unusually dark colour of skin; he had, in fact, the tint of a Cafuzo, the offspring of Indian and negro. It was thought he had belonged to some perfectly wild and houseless tribe similar to the Parapartas of the interior of South America. His face was of regular oval shape, but his glistening black eyes had a weary, distrustful expression, like that of a wild animal, and his hands and feet were small and delicately formed. Soon after his arrival, finding that none of the Indian boys and girls in the houses of our neighbours understood his language, he became sulky and reserved; not a word could be got from him until many weeks afterwards, when he suddenly broke out with complete phrases of Portuguese. He was ill of swollen liver and spleen, the result of intermittent fever, for a long time after coming into our hands. We found it difficult to cure him, owing to his almost invincible habit of eating earth, baked clay, pitch, wax, and other similar substances. Very many children on the upper part of the Amazons have this strange habit, not only Indians, but negroes and whites. It is not, therefore, peculiar to the famous Otomacs of the Orinoco described by Humboldt, or to Indians at all, and seems to originate in a morbid craving, the result of a meagre diet of fish, wild fruits, and mandioca meal. It appears this youth was very intelligent, and acquired considerable expertness in his master's art of goldsmith.

As to the naturalistic features of the work, we may state that it contains descriptions and illustrations of the Sauba Ant, climbing palm, Ampulus horns, Assai palm, bird-killing spiders, flat-topped mountains of Pará, Guará laver, Amazons sacklearing caterpillar, and many other interesting natural objects.

SEA INDUSTRIES.

The Harvest of the Sea, including Sketches of Fisheries and Fisherfolk. By James Bertram. Third edition, with Fifty Illustrations. London: John Murray, Albemarle-street.

The author, in the preface to this third edition, tells us that the work has been a great success as promotive of fishing economy, showing that it has not simply served the purposes of pleasing the eye by its illustrations, and the mind by the agreeable strain of its descriptive matter, but has really afforded good practical information as to the character, and suggestions for the advancement of, our great fishery industries.

In the present edition the matter is thoroughly revised, much that was contained in former editions being excised, as out of date, or otherwise unnecessary, and a considerable amount of new and interesting information introduced. Recent official statistics of the Scotch and Irish fisheries are included in this edition, and a new chapter on Aquariums and Fishery Exhibitions has been interposed, as well as new stories of fisher life.

We regret that want of space prevents our presenting our readers with some samples of the work. As regards the practical science of the subject nothing is, perhaps, so important as the statements with regard to artificial spawning and hatching. We heartily commend the present edition of this work to the attention of our readers.

We are unavoidably compelled to postpone till our next issue reviews of the following works:—

"An Easy Introduction to Chemistry." Edited by the Rev. A. Rigg, M.A. (Rivingtons.)

"Elderhort's Blowpipe Analysis." Edited by Messrs. Mason and Chandler. (T. Ellwood Zell.)

"Treatise on Practical Solid or Descriptive Geometry. By W. Timbrell Pierce. (London: Longmans, Green, and Co.)

"The Naturalist in Nicargua." By Thomas Belt, F.G.S. (London: John Murray.)

"Life of Mrs. Somerville." A pleasant story of the life of an agreeable woman of high scientific attainments.

"Watchwork." Review of a Treatise on Watchwork, Past and Present. By Rev. H. L. Nelthropp, M.A., F.S.A. With illustrations. London: E and F. N. Spon, 48, Charing Cross; New York: 446, Broome Street. 1873.

THE ECONOMY OF FUEL BY THE USE OF IMPROVED GAS APPARATUS FOR COOKING PURPOSES.

By E. R. Southby, Esq., M.R.C.S.

The following is a report of the paper on this subject read at the meeting of the Inventors' Institute on the 27th November last, as stated in another column.—

Gentlemen,—In the following remarks, I shall confine my attention to the production and utilisation of comparatively low temperatures, as, for domestic purposes, only such are ordinarily required. I shall further restrict myself to the utilisation of gas for cooking purposes. I hoped to have also dealt with the subject of warming by gas, but pressure of other business has prevented my doing so. Cooking divides itself into three principal branches—boiling, roasting, and baking; which I will take in the order named. In boiling by gas, except in certain special cases, the greatest economy is secured by impinging a flame of considerable intensity, such as that from a Bunsen or other air burner, directly on the bottom of the vessel containing the water to be boiled, and when a supply of hot water or steam to cook substances placed in a separate vessel is required, this plan may be safely adopted. There are, however, the following serious objections to all varieties of air burners:—First, offensive smelling and noxious products are usually formed when the flame is caused to impinge on comparatively cool surfaces, owing to its temperature being reduced too low for perfect combustion. Secondly, the flame in all these burners, as at present constructed, is more or less liable to "drop," as it is called. That is to say, the gas ignites not at the burner proper, as it ought to do, but within the tube of the burner at the point where the gas issues from the gas pipe for mixture with air before reaching the burner. The consequence being, that acroline, soot, and other offensive products are formed in large quantities. This dropping always occurs in Bunsen burners when the flame is lowered below a certain point. Guage burners are not so liable to it when the guage is perfect and of the proper mesh, but they soon get out of order, when they are more objectionable than the Bunsen. This liability to dropping when the supply of gas is reduced greatly diminishes the economy, for if the burner is large enough to bring the water rapidly to the boil, it cannot be reduced low enough to only just maintain that temperature without causing it to drop. The following results of experiments made with various burners will serve to illustrate my meaning.

(Mr. Southby here gave the details of those experiments, and then proceeded.)

The air burners have, therefore, only the advantage in economy, in heating the water to the boiling point, with the serious disadvantage of the offensive smell they produce. On turning off the gas to the point required to just maintain ebulition, which is the point at which most cooking operations are carried on, all advantage in economy disappears, and the simple jet burner, with its absolute freedom from smell, does the work better, for it maintains at all times an even temperature over the whole bottom of the cooking vessel, and, if anything, with a smaller rate of consumption than the offensive air burner. What is still wanted is a simple apparatus to heat water to the boiling point, more economically than the air burner, and without its drawbacks. We think we have succeeded in accomplishing this, but I am not prepared this evening to enter into details further than to say we can raise one gallon to the boil with under 3½ ft. I may here mention, as a simple means of rapidly procuring a large supply of hot, or even boiling water, R. W. Maughan's "Geyser." (A model of which Mr. Southby here exhibited.) It consists of a burner composed of horizontal tubes with fine perforation, through which the gas burns without previous admixture of air (an air burner is quite inadmissible in this apparatus), a conical combustion chamber, with a hemispherical cap over its upper opening, with a space between the two for the heated air to ascend, a second cap so arranged as to direct the stream of water partly against the outside case and partly over the first cap. An outer case enclosed the whole, from the top of which springs a cylinder, acting as a chimney, and containing an arrangement of spiral wires over which the water to be heated flows in a thin film. Above this is the cold water reservoir, with a perforated bottom to distribute the water, and a jacket outside with a space between them to allow the escape of the products of combustion which have, by the time they arrive there, accomplished their purpose. The Geyser is certainly a very ingenious and useful apparatus. Heating, as one of the larger sizes does, a full-sized bath in ten minutes, and children's baths in a still shorter time, it may frequently even be the means of saving life in cases of sudden illness. For boiling water it is about equal to the air burners in economy, the larger sizes requiring 4 ft., and the smaller ones 5 ft. of gas per gallon of water, from 60° to 212°. For heating large quantities of water to 100° the economy in cooking is much greater, the gas required being only at the calculated rate of 3 ft. per gallon of water heated 152°, that is the number of degrees between 60° and 212°. Gas, however, can only under special circumstances compete in economy with solid fuel for boiling purposes, except where the quantity of water to be boiled is small. Extensive establishments should always have a well-arranged steam generating apparatus heated by coal or coke, to effect their larger boiling operations.

We have, as yet, chiefly considered the raising of water to the boiling point, but this constitutes but a very small part of even the boiling department of cookery. The large proportion of operations are on a very small scale, and where the cooking is only for six or seven persons, all the operations are small. In some of these, full ebulition is never required, and in most of the others, as soon as it is reached, the heat must be reduced so as only just to maintain that temperature. For all these the simple jet burner, as arranged in Southby's apparatus, is at least as economical as any other, and is the only one that can produce perfect results, as it is the only one that keeps the whole bottom surface of the cooking vessel at a uniform temperature, and at the same time a temperature that can be regulated without trouble, and with unfailing accuracy. With this burner, there is no burning of the substances, in process of cooking, to the bottom of the vessel, and even in preserving, usually one of the most troublesome operations, requiring unremitting watchfulness, but little attention is required. The reason for this is evident, instead of the heat being derived from absolute contact with flame as in other burners, it is only heated air and radiated heat that reach the surface of the cooking vessel. Air burners can of course be arranged to a certain extent to act in the same way, but directly the flame ceases to envelope the surface of the vessel, their only advantage vanishes, whilst their disadvantages in great part remain. Frying and cooking in heated fat can also be conducted most perfectly and economically over these burners, and by means of a reflecting cover the toasting of bread can be quickly and perfectly accomplished, about four minutes being sufficient.

I now come to roasting—the second great operation in cookery. To arrive at perfection in roasting, on the old system, is so difficult, that Soyer declared none but born roasters could accomplish it. The gas roaster has now made it one of the most simple, and certainly successful, processes that can be imagined. The economy of gas for roasting purposes over all other fuel is pre-eminent and indubitable, whether on the largest or the smallest scale, whether for roasting an ox or a delicate leg of Welsh mutton. The economy, indeed, is so evident that accurate experiments seem scarcely needed to prove it. You have only to look into a kitchen where even an eight or ten-pound joint is roasting before an open fire, to see the frightful waste of heat. In gas roasting, on the contrary, the heat can be economised more perfectly than in almost any other operation. Certain rules in the construction of the apparatus must, however, be strictly adhered to. In some of the oldest gas roasters, the meat was hung in a cylinder, forming a chimney to a number of jets burning at its base. This plan was, however, very faulty. The heated air was allowed to escape before it had done its work, and a great portion of it before it had even come in contact with the meat. The dripping also, in spite of numerous contrivances to prevent it, was always falling on the burners, choking them, and giving off torrents of offensive vapours. The results were an abominable smell, great waste of gas, and very imperfect roasting. Leoni's improvements were among the first that altered this state of things. In his patent apparatus there is no opening at the top, so that the heated air is kept in contact with the meat sufficiently long to enable it to do its work. The consumption of gas is thus considerably diminished, and more perfect and uniform results are secured. Another form of apparatus has been lately introduced, in which the meat is cooked by jets placed above instead of below it; but the consumption of gas is said to be very large, and the results uncertain. I now come to my brother's patent apparatus, now being manufactured by the Economic Gas Range and Roaster Company, by which we think a further great improvement in gas roasting has been effected. A short description, and the results of a few carefully-made experiments, will enable you to judge whether we are correct in our estimate of this invention. The roaster consists, as you see, of a chimney, open at the top and bottom, in which the gas is burnt in a strong current of air. The burner used is composed of No. 2 cannel fishtail jets tapped into a piece of iron tube; by using this very small sized jet the richest gas can be burnt without danger of its smoking. There is also a dripping pan with a gridiron resting on it, on which to place the meat, and a cover that rests on the dripping pan, leaving a space between the two for the escape of the vapours, and enclosing beneath it the upper portion of the chimney as well as the gridiron and whatever may be placed thereon. The result of this arrangement is that when the gas is lighted a powerful current of highly-heated air rushes through the chimney to the top of the cover, where, as there is no opening, it diffuses itself, and descending as it cools, ultimately passes out between the edge of the cover and the dripping pan. It is evident that on this plan, that portion of air coming in contact with the meat in process of roasting, will be most rapidly cooled, and will at once drop downwards and pass away under the edge of the cover, carrying with it the meat vapours, which, if retained at a high temperature in contact with it, give it that disagreeable and unwholesome flavour

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THE

SCIENTIFIC REVIEW,

AND

Journal of the Inventors' Institute.

VOLUME VII.

"Scire velis, meâ cur ingratus opuscula lector
Laudet ametque * * * * *
Non ego ventosæ plebis suffragia venor,
Non ego nobilium scriptorum auditor et ultor."

Hor., Ep. I. 19.

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Chairman of the Council: SIR ANTONIO BRADY.

NOTICES.—SESSION 1873-4.

THURSDAY, JAN. 8TH, 1874.—Conference of Council and Members on "Patent Law Reform."

THURSDAY, JAN. 22ND.—On "Communication Apparatus for Railway Trains." By F. ROWE, Esq.

TO MEMBERS OF COUNCIL.

Council meetings to take place at 7 p.m. on same evenings.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

At the second members' meeting, held at 4, St. Martin's-place, Trafalgar-square, on Thursday, Nov. 27, Mr. F. H. VARLEY, Chairman of the Ordinary Council, or Executive of the Institute, presided, when E. E. SOUTHBY, M.R.C.S., read a paper "On Economy of Fuel by Economic Gas Cooking Apparatus," which is given in another column.

After the paper had been read, the following discussion ensued:—

The CHAIRMAN, in inviting discussion, said that Mr. Southby's statements, as he understood them, proved that when the proper economic apparatus was used, gas as fuel was twelve times cheaper than coal. This was, he thought, a great stride when we considered the high price of coal, which was more likely to go up to 60s. per ton than to go down below its present price; and, further, that the improved economic apparatus just described reduced the cost of gas fuel to four times cheaper. To his mind, the great thing that makes the use of gas preferable to coal was that the waste which takes place in an open fire was avoided. For before you can, with any comfort, cook before an open fire, the time taken, after lighting, will be about twenty minutes, and during that time the heat is being wasted. Now, with gas cooking this is not the case, as the requisite heat for cooking you can obtain in a very few minutes after lighting, and gas therefore offers very great facilities for roasting and other purposes. But he would ask Mr. Southby whether the cyanogen produced by air burners, in any way, appears in his roaster.

Mr. BARTLETT remarked that he had heard the paper that evening with great pleasure, and he was there to testify to the efficiency of Southby's apparatus in point of economy, for, having used many different gas cooking apparatuses, he could truly assert that Southby's was the best, and he had used it for a long time past. Air burners he had tried, but he found them objectionable, as they were liable to "drop." Leoni's he had also tried, and he had come to the conclusion that Mr. Southby's was the most economical form for use in cooking or roasting. He generally used the single

[CONTINUED ON PAGE 8.]

Monthly Notices.

Dr. Johann August Friedrich Breithaupt, one of the most distinguished mineralogists of Germany closed a long and useful life on the 22nd of last September. Born at Probstzella, near Saalfeld, in Saxe-Meiningen, he was educated at Jena and at Frieberg, in Saxony. With the Royal Saxony Mining Academy of Freiber Breithaupt's name has long been closely associated. His official connexion with the Academy commenced in 1813, and extended over more than half a century. On the death of Werner, in 1817, Briethaupt succeeded as Lecturer on Mineralogy, or rather on "Oryktognosie," as the science was then called. During his lifetime he published about 150 scientific memoirs, and several valuable works on mineralogy. "Die Paragenesis der Mineralien" is, perhaps, the work by which Breithaupt is best known to the scientific world. No man ever equalled Prof. Breithaupt for acquaintance with the physical constitution of minerals.

Les Mondes for November 6th gives a full account of the new combustible of M. Pagliari, which, in these times of dear coal, may attract some attention. It consists of petroleum, rosin, coal-dust, charcoal-dust, saw-dust, and sulphate of lime. It is stated that the calorific power of this combustible is more than double that of coal.

Plastic Carbon.—In the "Polytechnisches Notizblatt," Prof. V. Kletzinsky recommends a "plastic carbon" for filters, which is said to answer admirably. It is composed of coke, animal, and wood-charcoal, and pipe-clay. The ingredients are dried and reduced to powder, then mixed with molasses to a plastic state, baked in a muffle, soaked in dilute muriatic acid, washed, dried, and baked a second time.

Proposed Physical Society.—Meetings has been held in the Physical Laboratory of the Science Schools at South Kensington, to promote the formation of a Physical Society, the chair being taken by Dr. J. Hall Gladstone, F.R.S.

An International Scientific Series is now publishing by Messrs. H. S. King & Co., there will be a work on the "New Chemistry," by Professor Josiah P. Cooke, of the Harvard University. The same firm have in the press a work on the "Prolongation of Human Life," by Dr. John Gardner, the author of a well-known treatise on Domestic Medicine.

Waste of Power by Friction.—Prof. Fleeming Jenkin, in his inaugural address in the University of Edinburgh, on November 4th, described an experiment which he had been enabled to make in the cotton works of Messrs. Crosse and Winkworth. The connexions of 20,000 cotton-spindles were broken, and it was found that one-tenth only of the power produced was necessary to spin the thread; more than half is required to drive the machinery used; one-third is required to overcome the friction of the engine and the shafting alone. Less certainly than one-sixth, perhaps as little as one-tenth, of the whole power is required to prepare and spin the cotton. Here is a vast field open for the exercise of ingenuity.

Death of Professor Agassiz.—The *Daily Telegraph* thus records the death of this eminent natural philosopher:—Louis Agassiz, the distinguished professor of geology and comparative anatomy, who has just died in America, was a native of Orbe, in the canton of Vaud, Switzerland, where he was born in 1807. He was educated at Biel, Lausanne, Heidelberg, and Munich, giving from an early period proof of a strong bent for the study of natural science. At Munich he became associated with Martius and Spix, and published a descriptive work on a large number of new species of fish, which Spix had discovered in Brazil. This volume appeared in 1839, and for several years afterwards Agassiz devoted himself to ichthyology, embodying his views in large and important works that were published in France, England, and Germany. From the fresh-water fish of Central Europe, in the observation of which he was assisted by Carl Vogt, he proceeded to fossil ichthyology, while these researches, in their turn, led to his well-known investigation of the theory of glaciers. His views on this subject attracted much attention. Agassiz endeavoured to prove that the movements of glaciers and the transport of them by large boulders were accounted for by a somewhat sudden and general access of cold over the surface of the globe, a glacial epoch immediately preceding the existing period of the world's history. It was during his researches in Switzerland—Agassiz being then Professor of Natural History at Neufchatel—that he was visited by Prof. Forbes, who anticipated his friend by making public a theory of the viscous constitution of glaciers, which has recently found a defender in Mr. John Ruskin. The studies of Agassiz on this subject retained a charm for him up to the last—his latest inquiries being into the glacial remains

on the Pacific coast of Central and South America. He had also examined minutely the Atlantic and Gulf coasts. Quite recently he superintended the American deep-sea explorations. Professor Aggasiz was a believer in the doctrine of successive creations of advancing organisms, and a strenuous opponent of Mr. Darwin's theory of evolution. In the course of the anthropological discussions of recent years, Agassiz has declared in favour of the original plurality of races of mankind. Few of the savants of the present day have observed and written so much, or enjoyed a wider reputation. He was elected a correspondent of the Institute so early as 1839, and was only a few years ago awarded the grand prize of the Academy. He had many friends in this country, and on several occasions has made use of British geological museums. Since 1846, when he accepted a professorship at Harvard College, his writings have been chiefly devoted to the natural history and geology of America, and they have in a great measure given the tone to the prevaling scientific opinion and research in the New World

THE INVENTORS' INSTITUTE.

[CONTINUED FROM PAGE 7.]

cover, and, in fact, preferred it to the double cover. He had found that a small joint of meat could be cooked at the expense of about eight or nine feet of gas per hour. Another great advantage he had found consisted in the fact that a person who had never before practised cooking could, with the greatest ease, cook a joint, of course with the slight expenditure of common-sense. Of this he had practical experience. The products from this roaster he had found were of the purest description, and of the efficiency of the invention he had no doubt.

Mr. MACOMBER asked Mr Southby whether a steak could be done by his arrangement, and Mr. Southby said that his arrangement admitted of it being done, and that indeed very well; and in this he was confirmed by Mr. Bartlett, who thought that a steak cooked in this roaster was of quality superior to those done before an open fire, and that the time taken to cook it was about a quarter of an hour. In fact, anything could be cooked well except chops, which he could not say he preferred to be cooked in this range any more than any other gas apparatus. Even water-fowl he preferred cooked by Mr Southby's method.

Mr. SOUTHBY, in answer to a question, said that he preferred the arrangement as now constructed, that is, with a double cover.

Mr. TOOTH having made some remarks in favour of the invention,

Mr. BARLETT said he would claim the indulgence of the meeting to allow him, as a chemist, to state his opinion that cyanogen was not produced in Southby's apparatus, though here and there a trace could be tasted. In this apparatus a larger body of air must impinge upon the meat, and the objectionable products—that is, the meat fumes which pass away under the cover—do not come in contact with the meat.

Mr. SOUTHBY said the meat in all cases is absolutely covered, and it is always found that the products of steam is being given off.

Mr. CAMPIN said that there was a prejudice in people's minds against gas cooking, but for several years past one of the common gas cooking stoves had been used in his house, where they had never found any objection except that the fatty matters were liable to drop upon and choke up the gas jets; moreover, the common apparatus was not cheap as to cost of fuel.

Mr. MAUGHAN said that his experience was decidedly in favour of cooking by gas. He partook some forty years ago of a joint cooked by gas, and he had never since partaken of a joint so well done as that was.

The CHAIRMAN said that what struck him most was the marvellous simplicity and ingenuity of the invention, which left nothing to be desired. He supposed he must call on Mr. Southby to reply, but he thought that the questions that had been raised were answered. The only question he thought might be considered left open was the cooking of a chop, which, he admitted, generally speaking, was the one weak point in his, and all, gas cooking arrangements, but he thought that you could not expect a gas apparatus to do that, for cooking a chop was the most severe test that could be applied.

Mr. MACOMBER, in proposing a vote of thanks to the reader of the paper, said the question with regard to cooking a steak had been answered to his entire satisfaction. He did not enter into the question of a chop, that was not his intention, because he preferred a steak. He begged to propose a vote of thanks to the reader of the evening for his able paper, and he would also take occasion to remark that the meeting was greatly indebted to Mr. Bartlett for giving the results of his experience.

The CHAIRMAN said that Mr. Macomber had anticipated him in moving the vote which was put and carried unanimously.

Mr SOUTHBY briefly returned thanks, when the SECRETARY (Mr. Campin) proposed, and Mr. MORGAN seconded, a vote of thanks to the Chairman of the evening, which was put and carried unanimously.

The SECRETARY then announced that on Dec. 11th, the paper to be read would be "On Automatic Railway Couplings," by W. Gadd, Esq., C.E., and the meeting dissolved.

At the Council meeting (ordinary), preceding the above members' meeting, Mr. F. H. VARLEY in the chair, after the confirmation of the minutes of the last meeting, a resolution was passed appointing a committee consisting of Messrs F. H. Varley, H. Williams, D. J. McLauchlan, C. G. Carttar, A. J. Murray, F. W. Campin (the Secretary), and the other *ex officio* to take immediate action for progressing Patent Law Reform.

At the third members' meeting on Dec. 11th, Mr. W. GADD, C.E., read the paper announced to be read at the meeting on Nov. 27th.

The council (ordinary), as usual, met before this meeting, confirmed the appointment of the committee for progressing Patent Reform and transacted formal business.

The report of the members' meeting we are compelled to postpone.

The following gentlemen have been placed on the list of members:—J. Beale, P. H. Williams, W. H. Silcock, J. McSkimming, Marshall, Adams, Penrose, M. Fenton, O. C. D. Ross, Capt. T. R. D Bingham, H. W. Pendred, C.E., J. Fielding, J. Ellis

SOUTHBY'S GAS COOKING APPARATUS.

(Continued from Page 6.)

by which everyone recognises ordinary oven cooking. To prevent this taste of the oven, it is the meat rather than the oven that requires to be ventilated, that is to say, it is necessary to cause a rapid current of heated air to pass immediately in contact with the surface of the meat. Now, in the old form of gas roaster, as the heated air could pass out at the top of the apparatus, it would, of course, take the shortest, most direct, and least obstructed course, avoiding the meat, and rushing up through any clear spaces. The result was not only a heavy loss of heat, but, as no current of air passed over a great portion of the surface of the meat, imperfect ventilation and unpleasant flavour. In Leoni's apparatus the heated air cannot pass away without doing its work; gas is saved, and a certain amount of ventilation secured; but, as there is no brattice between the upcast and downcast currents, the results are still far from perfect. In Southby's economic apparatus, the chimney forms a perfect brattice, and the laws of nature are allowed full play. The heated air can freely rush to the top, and as, in accomplishing its work, it loses its heat, and becomes saturated with the meat vapours it is so essential to get rid of, its constantly increasing density causes it to fall until it passes freely away at the bottom. In gas roasting, air burners of all varieties are objectionable, and as, in this case, they have no possible advantage, even in economy, over the simple jets they should never be used. With the simple jets burning in a chimney, it is impossible that any unpleasant flavour or taint can ever be communicated to the meat, but if air burners are used the flame may drop and spoil the roast. I must here say a few words in answer to an objection raised against roasting meat in contact with the products of the combustion of gas. Three conclusive answers can be given to this objection. The first is that what we are content to take in large quantities diluted over our palates (and through our noses) into our lungs will surely not injure a roasting joint of meat by coming in contact with its surface. We use the same jets and the same gas for roasting that we light our rooms with, and the products must in both cases be the same. The second answer is that coal gas being derived from coal simply by distillation, can contain no elements that coal does not contain, and the products of combustion as long as it is perfect, must be the same, with this exception, that as the sulphur which exists in coal has been almost entirely removed from the gas, there are mere traces of sulphurous acid, produced instead of the large quantities yielded by coal. Everybody will, I think, agree with me that no meat can be more free from taint than a chop or steak broiled on the top of a bright open fire, and yet it is certainly cooked in the products of combustion in their most concentrated form. The third answer is that gas, when perfectly burnt in air, produces only carbonic acid and water, the exact compounds you have in a bottle of soda water, yet who would think of objecting to the vapour of such a remarkably innocent body coming in contact with the roasting joint. I am of course always speaking of perfect combustion, and it is because the combustion in air burners is liable to be by no means perfect, that I totally object to their use in gas roasting. I believe to their use may be traced the greater portion of the prejudice existing in many people's minds against gas cooking. I will now give the results of two experiments with our No. 1 roasters to demonstrate their economy. The first was on a sirloin of beef, weighing six pounds twelve ounces raw. It was cooked in the ordinary No. 1 roaster, with a plain sheet-iron cover. The time taken in roasting, from lighting the gas, was one hour fifty-five minutes, and the gas consumed 7½ feet, being at the rate of 3¾ feet per hour. It was rather underdone, and for those who prefer meat without a shade of red down to the bone, should have been left in thirty-five minutes longer, during which time 2¼ feet more would have been consumed; so that we may say a joint of about seven pounds in the No. 1 roaster, if required underdone, takes two hours and 8 feet of gas; if required very well done, it takes 2½ hours and 10 feet of gas. The present value of 10 feet of common gas in London is one halfpenny. This sirloin of beef weighed, when roasted, five pounds fifteen ounces, and the dripping from it eight ounces, making the loss only five ounces. The second experiment was made with a No. 1 roaster with this form of cover; it is exactly like the other, but with an outer casing of tin, leaving a space between the iron and tin of about one inch at the crown, running away to nothing at the

edge, where the tin is closed tightly over the iron. This outer tin case or jacket, with the layer of still air enclosed between it and the iron, prevents a large amount of radiation. In this case, a leg of Welsh mutton, weighing five pounds raw, was roasted in two hours and ten minutes, with rather under 5¾ feet of gas, being at the rate of just over 2¾ feet per hour, that is to say, the gas consumed by one very small burner. The leg of mutton was very well done, in fact, too much done to suit the taste of many people, and that with one farthing's worth of gas. The leg weighed, when raw, five pounds, when roasted, four pounds, besides which, there was 4½ ounces of gravy, and 3½ ounces of dripping, making the loss eight ounces. I wish to draw your particular attention to the rate of consumption per hour, as that governs everything. In these roasters any sized joint can be cooked that you can get under the cover, and in all cases the rate of consumption per hour will be the same, only the larger the joint the longer time it will require. Now, the rate for the No. 1 roaster with single sheet-iron cover is four feet per hour, the largest sized joint you can get into it seven pounds, and the time required for such a joint 2½ hours, total gas required, ten feet. The rate for the No. 1 roaster with double cover, sheet-iron inside and tin outside, is 2¾ feet per hour, and in the same way with a seven pound joint taking 2½ hours, the total gas required is 6¾ feet, costing only a small fraction over one farthing. This will, I think, be allowed by all to be a triumph of economic roasting.

I will now consider briefly the third operation, baking, and more especially pastry baking, for as few families bake their own bread in towns where gas can be obtained, baking bread by gas is of little importance. Our roasters, whether in the separate form or combined in a range, will, however, bake bread very satisfactorily. For baking pastry, gas roasters are superior to any form of oven, both in economy, ease of working, and perfection of results. What is essential for this purpose, is a temperature that can be regulated to the greatest nicity and maintained perfectly uniform as long as it is required. This can only be secured by the use of gas. Even the best arranged ovens heated in the ordinary way are constantly varying in temperature burning the pastry at one minute, and not cooking it with sufficient rapidity to prevent it becoming sodden at another, besides the expense and labour of getting up the heat to a sufficiently high point to begin with. With Southby's gas roaster, on the other hand, the temperature is raised to the exact point required in two or three minutes, and can be maintained at exactly the same point for any length of time. For baking, as for roasting, the economic gas roaster secures perfect results with the greatest economy in both fuel and labour. For ordinary family use, the gas range, especially if combined with a good water heating apparatus also worked by gas, is an enormous economy over the ordinary kitchen fire, whether in an open or close range. For at least eight months out of the twelve, no kitchen fire need be lighted at all, and when a small fire becomes necessary for warmth, it can be utilized for boiling, and only the roasting portion of the gas range kept in operation; or the range may be put on one side, and a gas roaster substituted. In these days, too, when good domestic servants are becoming daily more difficult to find, the advantage of having an apparatus by means of which the most inexperienced can cook a dinner respectably, and that without annoyance from dirt or heat, is certainly very great. For these reasons, I have faith in the rapid extension of cooking by gas; and, effecting as it does a very great saving in the consumption of coal, I think I may say that its adoption to the greatest possible extent is a subject of national importance.

Proceedings of Societies.

ROYAL SOCIETY.

November 20th.—The President in the chair.—The following papers were read:—"Note on the Electrical Phenomena which accompany Irritation of the Leaf of *Dionæa muscipula*," by Dr Sanderson; "On the Algebraical Analogues of Logical Relations," by Mr. A. J. Ellis.

SOCIETY OF BIBLICAL ARCHÆOLOGY

December 2nd, 1873.—Dr. Birch, K R., F.S.A, F.R.S.L., President, in the chair.—The following papers were read:—1. "Future Punishment of the Wicked, a Doctrine of the Assyrian Religion." By H. Fox Talbot, Esq., F.R.S. In this sequel to the learned author's former papers, he tried to prove from his Legend of the Descent of Ishtar to Hades, especially lines 32-6, "of the lighting up of consuming flames to envelop the abusers of the conjugal tie," that torments for the wicked in the world after life must have been doctrinally taught in the Assyrian religion, which portion he illustrated by many grammatical and archæological notes. 2. "Notes from Borneo, illustrative of Passages in Genesis." By A M Cameron, Esq. In this paper the author cited a Dyak tradition, that at an archaic general inundation, the ancestors of the Chinese, Malay, and Dyak had to swim for their lives, and (possibly founded on this tradition) the Dyak preserved his weapons, and the Chinaman his books. A second tradition stated that an ancestral Dyak made a ladder to go up to heaven, unhappily one night a worm ate into the foot of the ladder and brought all down. Mr. Cameron further stated that one of the two Dyak names for the Supreme Being is Youvah; the author refers to the similar sounding Jehovah and Yahveh of the Bible. Seven new members were elected.

ZOOLOGICAL SOCIETY OF LONDON.

December 2nd, 1873. Dr A Gunther, F.R.S., Vice President in the chair. The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of October and November, and called particular attention to two Sand Badgers (*Meles ankuma*) from Japan presented by Lieut. the Hon. A C. Littleton. The Secretary exhibited and made remarks on a fine head of *Alcelaphus tora*, which Mr. Edwin Ward had sent for exhibition. This animal had been obtained by Mr C. L. Arkwright on the Settite in Upper Nubia. Mr. J. W. Clark exhibited and made remarks on the remains of a Martin Cat from the Fens of Cambridgeshire. A communication was read from Dr. James Hector, C.M.Z.S. containing an account of the complete skeleton of *Cnemiornis calcitrans*, Owen, and showing its affinity to the Natatores. Professor Owen, F.R.S., read a paper containing a Restoration of the Skeleton of *Cnemiornis calcitrans*, Ow., with remarks on its affinities to the Lamellirostral group, and forming the twentieth part of his series of Memoirs on the Extinct Birds of the genus *Dinornis* and its allies. A communication was read from Mr. W. H. Hudson, C.M.Z.S., containing an account of the habits of the Pipit (*Anthus correndera*) of the Argentine Republic. A communication was read from Mr A. G. Butler, F.Z.S., containing a revision of the species of the genus *Prionopnis*. A communication was read from Dr. J. E. Gray, F.R.S., on the skulls of some Seals from Japan, with description of a new species, proposed to be called *Eumetopias elongata*. Mr. P. L. Sclater read a paper on some Birds collected in Peru by Mr. H. Whitely, being the seventh of the series of articles upon this subject. A communication was read from Mr. Henry Whitely, C.M.Z.S., containing additional notes on Humming Birds collected in High Peru. A communication was read from Mr. R. Swinhoe, F.Z.S., containing remarks on the Black Albatross with flesh coloured bill, of the China Seas. Mr. Garrod read a paper on the visceral antomy of the Ground Rat (*Aulacodus swinderianus*).

GEOGRAPHICAL SOCIETY.

November 24th.—Sir H. Bartle E. Frere, K C B., President, in the chair.—The paper read was, "Recent Discoveries at the Eastern End of New Guinea," by Capt. J. Moresby, R N. In this paper, forwarded to Sir H. Rawlinson by its author, who is still continuing to cruize in the South Pacific, an account was given of the voyage of H.M.S. *Basilisk* to New Guinea, in the beginning of the present year, undertaken with a view to completing the unfinished survey of the late Capt. Owen Stanley. The following Fellows were elected: Lieut. W. A. D. Acland, C. E. Alforth, J. Allen, H. C. A. Angelo, Lieut. G. G. Baker Cresswell, H. H Batten, W T. Blanford, Lieut. H. C. Carey, F. D. Chauntrell, S Cheetham, Sir J. Clark, Bart, K Cochrane, J. Constable, E. A. de Cosson, G. P. Craufurd, Chief Justice P Daly, Rev. R V. F. Davies, W. Elmslie, J Farmer, W. F Forbes, T Forshaw, E W. Foss, J. L. Geiger, J Gibbs, A L. Gordon, W. E Heeley, C.J. Hegan, W. H Hirst, Rev J. Jones, W. Jones, Col J P. Kennedy, J. D. Lee, T. Letts, T. Lovell, Col. R G. A. Luard, Sir F Lycett, W. Macaulay, A. MacEachen, W. Mackenzie, M.D., C.B., K. W. A G M'Alpin, Commander A. H. Markham, R N., H. M. Ormerod, E L. Oxenham F. A Phillbrick, J. S. Prance, Don M. Gonzalez de la Rosa, E E. Sabel, Col. W. H. Seymour, Dr P. Smith, J. Straughton, G. Sutherland, C. Taylor, J Tomlinson, Hon. G. Turner, W. J. Tyler, L. N Walford W. T. Western, and E. H. Winslow.

GEOLOGICAL SOCIETY.

November 19th. Professor Ramsay, V P., in the chair. Mr. H Francis and the Rev J. T C. Gullan were elected Fellows. The following communications were read; "Supplemental Note on the Anatomy of *Hypsilophodon Foxii*," by Mr. J. W. Hulke, "The Drift Beds of the North-West of England, Part I, Shells of the Lancashire and Cheshire Low Level Clay and Sands," by T M Reade; and "Note on a Deposit of Middle Pleistocene Gravel near Leyland, Lancashire," by Mr. R D Darbishire.

CHEMICAL SOCIETY.

November 20th. Dr. Odling President in the chair. A paper "On the Co-efficient of Expansion of Carbon Disulphide," by J. B. Hannay, was read by the Secretary, Dr. Russell then communicated his researches "On the Action of Hydrogen on Silver Nitrate," giving an account of the precipitation of metallic silver in the crystalline state by means of hydrogen; there were also a note "On the Action of Zinc Chloride on Codeine" by Dr. C. R A. Wright, "On the Chemical Properties of Ammoniated Ammonic Nitrate," by E Divers, M D., and "On the Analysis of a Meteoric Stone and the Detection of Vanadium in it," by E. Apjohn.

METEOROLOGICAL SOCIETY.

November 19th. Dr R. J. Mann, President in the chair. Messrs. W F Gwinnell, T Paulin, and J H M Walrond were elected Fellows; and the names of six candidates were announced. The following papers were read, "The Thunder-Storm at Brighton on October 8, 1873, and its Effects," by Mr. F E. Sawyer; and "Some Considerations suggested by the Depressions which passed over the British Islands during September, 1873," by Mr. F. Gaster; a discussion then took place "On the best form of Thermometer-Stand." It was resolved that the following conditions should be fulfilled.—1. The contained ther-

mometers must at all times be shielded from the direct rays of the sun. 2. The stand must be so arranged that even if when its own external temperature be raised, the thermometers shall not be thereby affected. 3. As reflected heat must diminish the accuracy with which thermometers indicate air or shade temperature, these disturbing causes should be excluded. 4. The temperature of the air alone being desired, it is necessary that the readings of the thermometers be not affected by radiation to the sky. 5. It being desirable that one pattern of stand be used in all localities, it follows that it should be absolutely independent of all surrounding objects. 6. There must be free access of air round the thermometers. 7. No rain should ever reach the dry-bulb thermometers, for if it does, it improperly lowers their temperature, making them read even lower than the wet-bulb. 8. The stand must also be unaffected by snow, both as a direct fall or from obstructed circulation of air. 9. It is very desirable that the stand require no attention between the hours of observation. 10. It is desirable, but not absolutely necessary, that room be provided for a duplicate set of instruments. 11. The stand should not be costly. 12. It should be capable of easy transmission by rail or otherwise. The meeting not having the results of the comparison of the observations made with the different stands at Strathfield Turgiss, the discussion was adjourned till after these are published.

THE INSTITUTION OF CIVIL ENGINEERS.

TUESDAY, Nov. 25, 1873. T. Hawksley, Esq., President, in the chair.—The paper read was an "Account of the Construction and Maintenance of the Harbour at Braye Bay, Alderney," by Mr. Leveson Francis Vernon Harcourt, M.A., M. Inst. C.E.

The harbour at Alderney, designed by the late Mr. James Walker, past-president Inst. C.E., was commenced in 1847. The Admiralty intended, in the first instance, to make only a small harbour, but subsequently gave directions for the enlargement of the scheme. In 1858 the design, then in course of construction, consisted of a harbour of 150 acres, with a depth of water of 3 fathoms and upwards, sheltered to the west and east by two breakwaters. The western breakwater, about 4,700 feet in length, had been constructed, but the eastern breakwater was abandoned, and the harbour was consequently exposed to winds blowing from any quarter between N.N.E. and E.S.E. Westerly winds, however, from which the harbour was well sheltered, were the most frequent and severe in that locality. The western breakwater was exposed to the whole force of the Atlantic, and the effect of the fury of the storms was increased at Alderney by the rapidity of the tides near the island, occasioned by a peculiar confluence of currents in the bay of St. Malo. The breakwater was constructed on the "pierres perdues" system, a mound of rubble stone being deposited in the line of the proposed work from hopper barges, towed out by steam-tugs. As soon as the mound was sufficiently consolidated it was surmounted by the superstructure. The stone was obtained from quarries at Mannez, on the north-east side of the island, distant about 2 miles, and was conveyed to the works by a railway. The superstructure consisted of a sea wall and of a harbour wall, 14 feet and 12 feet thick respectively, founded at first at the level of low water, and built without mortar entirely with this stone, the intermediate space being filled with rubble; the batter of the sea wall being 9 inches, and of the harbour wall 4 inches to 1 foot. To protect the lower or quay level, which was 6 feet above high water, a promenade wall was built on the sea side, about 14 feet high, consisting of two masonry walls set in mortar, with filling between. The outer wall rested on the sea wall, and the inner wall on the rubble filling between the sea and harbour walls; the whole forming the base of the upper or promenade level. As this structure proved liable to damage by storms the design was modified, in 1849, at 410 feet from the shore. The foundations of the sea wall were then commenced at 12 feet below low water, with a width of 23 feet at the base; the first five courses, each 3 feet thick, being composed of Portland cement concrete blocks, faced with granite headers, each course having a set off of 1 foot on the face. The upper portion of the sea wall was built of Mannez stone set in Medina cement, with a batter of 6 inches to 1 foot, and the width of the wall was increased 9 feet at low water level. The harbour wall was founded 9 feet below low water, and was 14 feet wide at the bottom. The first four courses were composed of Portland cement concrete blocks, the rest of the wall was built of Mannez stone set in cement, the batter of the face throughout being 4 inches in a foot. At the back the walls were carried up vertically, the space of 21 feet between them being filled with concreted hearting. The promenade wall was built of solid masonry in mortar, and both the upper and the lower roadways were paved with granite pitching and copings, and a line of rails was laid down on each level. The quay level was 6 feet above high water and 25 feet wide, and the upper level 14 feet higher and 14 feet wide.

The base was always carried out considerably in advance of the superstructure, so that three or four years could be allowed for settlement before building the superstructure upon it. Staging was erected in the line of the work, supported on round piles, which were buried a few feet in the base. The lower courses were then brought up to low water level, by divers, in lengths of about 60 feet. During each spring tide, in favourable weather, between April and September, the structure was raised nearly up to quay level. At the close of each season's work, a strong cross wall was built at the end to protect it during the winter, and the upper portions were completed in the winter months. The foreshore was raised, on the sea side, by tipping large stones over the wall, so as to protect the sea wall up to low water; and the harbour foreshore was raised to about 6 feet below low water close to the wall.

In 1860, when the superstructure had been carried out 2,700 feet from the shore, the design was somewhat modified. The breakwater was narrowed by reducing the width of the quay to 20 feet, the batter on the sea face was altered to 4 inches in a foot, solid masonry was substituted for the concreted hearting, and the foundations of the harbour wall were commenced at the same level as the sea wall. The head was built in 1864. The foundations were laid 24 feet below low water level, across the whole width of the breakwater. The first nine courses, each 3 feet thick, consisted of concrete blocks faced with granite headers, the upper portion was built of masonry in cement. The most exposed face stones were joggled and dowelled together, and several of the corner quoins were further secured by iron bars and diagonal straps. Two red leading lights on the shore marked the entrance to the harbour at night.

The work of maintenance had proved very difficult, owing to the great force of the sea. The superstructure had been damaged several times by storms during the winter months, but the breaches had in every instance been repaired in the following summer. The foreshore had also constantly been lowered near the sea face of the breakwater by the sea, and had only been maintained by continual deposits of stone.

The cost of the works of construction and of maintenance, to 1872, had amounted to £1,274,200, of which £57,200 had been expended in repairs. The harbour was transferred from the Admiralty to the Board of Trade in 1866. The engineers who successively had charge of the works were,—as Engineers-in-chief, Messrs. Walker, Burges and Cooper, Messrs. McClean and Stileman, and Sir John Hawkshaw; and as Resident Engineers, Mr. Parkes, Mr. Rhodes, Mr. May, and the Author. The contractors for the whole of the works were Messrs. Jackson and Bean.

The breakwater at Alderney, lying open to the west, was exposed to a far heavier sea than St. Catherine's breakwater on the east side of the island of Jersey. St. Catherine's breakwater, though built similarly to the original design for the Alderney breakwater, and stretching more than 2,000 feet into the sea, had been maintained at a very slight expense, and no foreshore had been deposited on the mound since the completion of the works in 1856. Besides being exposed to a very heavy sea, the outer portion of the Alderney breakwater was built in an unusual depth of water, reaching at the head to a depth of 130 feet below low water of ordinary spring tides, or to three times the extreme depth of the foundations of the breakwaters at Cherbourg and at Plymouth. The settlement of the superstructure on the huge mound, amounting to about 1-20th of the height of the mound, caused cracks in the masonry between the work of different seasons, which, though made good as far as possible, formed weak points to the attacks of the sea. The great recoil also of the waves from the high sea wall increased the force of the sea, drew away the foreshore from the wall, and helped to loosen the face stones. The damaging effects of the sea were not fully experienced till the work was completed, otherwise probably the evils might have been in a great measure averted by a modification of the design. To have carried the foundations lower, and to have made them level in cross section, with no structure above the quay level, and less batter on the sea face, would have strengthened the structure. But whether the Government would have sanctioned a considerable increase in expense was doubtful, and at the time of the latest modifications there were no sufficient reasons to justify such a change.

From a series of soundings taken by the Author in 1870, 1871 and 1872, it appeared that the rubble mound tended to assume a slope of 7 to 1 from the sea wall down to about 20 feet below low water of spring tides, changing at that depth to a slope of 1½ to 1. In shallow water the change of slope took place about 15 feet below low water, but the lower slope was flatter.

The mound was liable to be disturbed by the sea as far as 80 feet or 90 feet from the wall on the sea side, and to a depth of 20 feet below low water. Beyond those limits, which applied to the outer portion of the breakwater, all action of the sea ceased. The limit of depth varied with the depth of water in which the mound was situated, but the limit of distance remained approximately constant throughout the whole length of the breakwater.

APPLICATIONS FOR LETTERS PATENT.

(Continued from page 2.)

paratus for the purpose.—G. Haseltine. Electro-magnetic railway signal apparatus (com). (Complete specification.)—A. M. Silber and J. F. C. Farquhar. Construction of lamps and lanterns or similar apparatus used for lighting purposes, and apparatus for heating purposes.—J. Gray, Knt., M.P., and E. W. D. Gray. Apparatus for preparing paper for printing. H. P. Bashea. Water closets.—F. Wirth. Malt kilns (com.)—J. Peel and S. Easley. Pickers used in weaving.—W. Henderson. Apparatus for shunting railway trains.—W. Jones. Apparatus regulating the temperature of manufactories, conservatories, and other apartments or buildings.

On October 11th.—3388 to 3413.—J. Paterson and J. Hinde. Apparatus for fixing capsules on bottles.—W. Grant and A. Simon. Rules for drawing.—E. Loomes. Manufacture of boxes, more especially adapted or suitable for matches, splints, cigarettes, bonbons, and other ... articles.—H. Smith. Carving for... J. Noy. Sliding cramp for boots, shoes, and other articles having two or more parallel edges, and for bringing same together.—R. Guthrie. Lamps for burning paraffin and other hydrocarbon oils.—W. Tongue. Machinery for combing fibrous materials.—W. Bamber. Gas burner to be employed for gassing yarn.—T. H. Waugh and J. T. Waugh. Machinery for spinning and for doubling fibres.—W. Henderson. Signal apparatus to be applied to railways.—H. E. Newton. Mode of connecting gas, water, or other pipes (com.)—A. Fleury. Method of and appliances for determining the course or direction of bodies in air and water.—W. A. White. Combinations of ingredients for cleansing and bleaching wools and other suitable fibres and fabrics, paintwork, floors, casks, and other articles and utensils (com.)—J. Ellis. Arranging, planning, and constructing dwelling-houses.—W. A. Lytle. Candles.

Mr. Carmichael's letter, further explaining his invention of "Anti-Wave Motion Ships," and Mr. J. Napier's letter on "Tidal Engines," we are compelled to postpone till our next issue.

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THE
SCIENTIFIC AND LITERARY REVIEW,
AND RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,
INCORPORATING THE
Journal of the Inventors' Institute.

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*** Communications to the Editor to be addressed to him at 21, Cockspur Street.

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THE INVENTORS' INSTITUTE,
4, St. Martin's Place, Trafalgar Square.

Chairman of the Council—SIR ANTONIO BRADY.

The various efforts which have been made, and the numerous influences now at work to injure, if not to destroy, Patent Rights; the insufficiency of the many well intended, but ill considered, schemes of Patent Law Reform which have from time to time been suggested, and the tendency of which has generally been to prejudice the Inventor, without advantage to the Public; together with the proceedings so essentially involving the interests of inventors which have already taken place in Parliament, show the necessity of an immediate and active co-operation on the part of those interested in Inventions and in Patent Property, and that an Association for the Protection and Defence of Patent Rights is urgently needed. This Institute has, therefore, been established for the purpose of uniting and organising the influence of Inventors, Patentees and others. Its objects are:—

1st. To protect Inventors' interests and defend the privilege of obtaining her Majesty's Letters Patent.

2nd. To promote improvements in the Patent Laws.

3rd. To facilitate the diffusion of information with reference to Inventions and other subjects beneficial to Inventors and Patentees.

The qualification for Annual Members of the Institute is a yearly Subscription of One Guinea, and for Life Members a single payment of Ten Guineas.

Persons desirous of becoming members are requested to forward their names and addresses to the Secretary.

APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur street, Charing Cross.

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On October 16th.—3345 to 3346.—J. J. Bennett. Ornamental asphalte pavement and tiles.—R.

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On October 20th.—3390 to 3400.—R. Birch and W. McGiffert. Liquid stove polish (com.)—R. Baird. Furnaces for steam boilers.—W. Ambler and W. Gawthorp. Beer, water, and other liquid taps and valves.—W. R. Lake. Machinery for folding, piling, measuring, and examining textile fabrics and other like materials, and apparatus connected therewith (com.)—H. Salisbury. Machinery for washing and dyeing straw plait.—C. H. Wood. New motive power for engines.—J. Patterson. Machinery for boring rocks and other hard substances.—G. Kelley. Machinery or apparatus for spinning wool or other fibrous substances.—C. W. Keighley and W. Netherwood. Machinery or apparatus for cutting woollen or other good or corduroy.—H. Paddison. Balances or weighing machines.—G. Dyer. Domestic fire stoves or grates, or parts thereof.

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On October 27th.—3477 to 3491.—G. L. Brin. Modes and means for the manufacture of artificial butter, and for renovating rancid or bad butter, part of the apparatus being applicable to the pressing of stearine and other like purposes. —R. J. Worth. Steam pumps.—A. Wood. Manufacture of venetian blinds.—T. F. Finch, J. Finch, and A. L. Finch. Apparatus for economizing fuel in fire-grates.—T. Bradford. Machinery or apparatus for washing, boiling, rinsing, wringing, and drying wearing apparel, bed and other linen, or domestic or other textile fabrics, and partly applicable to other domestic or useful purposes.—[illegible]. Arranging and applying apparatus for indicating, recording, and giving alarms on the occurrence of change of temperature.—G. G. de L. Byron. Apparatus or looms for weaving (com.)—[illegible] Richard. Breaks and [illegible] of railway trains (Complete specification.)—T. G. Greenstreet. Filtering slop and drawing off the water by apparatus applicable to the ordinary slop-cart.—B. G. George. Method of transferring printed matter to plates of metal.—G. Hamilton. Motive-power engine to be operated by the pressure of water, steam, or compressed air, and capable of use as a pump, blowing engine, or gas exhauster (com.) (Complete specification.) —E. T. Truman. Means or apparatus for effecting intercommunication in trains, partly applicable to other purposes.—F. Wirth. Apparatus for preventing the wreck or foundering of ships or vessels (com.)—H. Bray. Manufacture of gas for illuminating and heating purposes.—J. Wadsworth. Apparatus for warming, ventilating, and cooking.

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Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE.

FEBRUARY 1, 1874.

REVISION OF THE PARLIAMENTARY REPORT ON PATENTS.

No. II.

The other propositions of the sub-committee of the Inventors' Institute (already designated *I. I. Com.*) are as follows:—

On paragraph No. 17, *H. C. Rep.* (*a*) and (*b*), the *I. I. Com.* referred back to their views expressed in regard to 6, 16, and 7, *H. C. C. Rep.*

On paragraph 17 (*c*), which refers to concurrent applications for patents, the *I. I. Com.* dissenting from this section, recommend that in the case of concurrent applications for a patent the patent to be granted to the first applicant, provided no fraud or collusion be proved.

On paragraph 17 (*d*) *H. C. C. Rep.*, which relates to Patent Litigations, the *I. I. Com.* assented to that part of this section which relates to trial before a judge, where the preferable resort to a Court of Arbitration cannot be had, but a special scientific jury should only be impannelled where a motion is made for such a jury, by one party to the suit, and the Court concurs, or where both parties concur in desiring it.

On paragraph 17 (*e*), *H. C. C. Rep.*, the *I. I. Com.* state—That no one who does not fulfil the conditions of having "legal scientific or technical experience, or whose time is occupied with other engagements to such an extent as to prevent their giving full attention to such administration," should be selected for the important office of Commissioner of Patents, and that if proper persons are selected they will not require coadjutors or reinforcement, and that their whole time must be given to their duties if necessary.

[This answer on paragraph 17 (*e*) is, it appears, not to be considered as signifying the desirability of scientific-technical Commissioners being appointed to act as subsidiary to a Chief Commissioner.]

On paragraph 17, *H. C. C. Rep.*, the *I. I. Com.* state their opinion that "relegation" of the duties entrusted to Commissioners who have themselves been chosen with reference to special fitness, is likely to prove unsatisfactory, unless they retain the full responsibility of the decisions arrived at. The Committee strongly object to any increase of the difficulties now thrown in the way of the obtainer of provisional protection, as they consider that the later stage is the proper one for making such investigations as may be deemed necessary, and that no investigation as to novelty, or as to the invention being properly the subject of a patent, will be productive of good results at any stage (unless of the modified kind proposed by the Inventors' Institute).

They consider, however, that if the Commissioners find an invention already recorded at the Patent Office, they should caution the intending patentee, and if they think fit endorse the same on the face of the patent, thus carrying out the principle of *caveat emptor*. On the clause requiring perfect accordance between a provisional and a complete specification, the committee have already expressed their opinion. No particulars (of practical details) can or ought to be given in a provisional specification, therefore no exact accordance on this point can be expected.

(*g*) Same paragraph—*I. I. Com.* state they have already expressed their objection, which they now confirm.

(*h*) Same paragraph—Accepted as most desirable.

(*i*) Accepted as desirable; but experience shows this is not easily practicable.

(*j*) Same paragraph—Accepted as sound in principle, but it is considered that fit persons should be entrusted with the work, and should be paid liberal salaries.

18 Accepted; with the proviso that no "*ex officio*" appointments shall in any case be made; that Patent Commissioners shall hold no other office, and shall give their whole time to the duties of the Patent Office.

On paragraph 18, it is to be observed that the new Patent Law Committee suggest that it seems desirable that in order to ensure direct Parliamentary responsibility, the President of the Board of Trade, and one of its Parliamentary secretaries, should be Official Commissioners.

19. Accepted.

Reviews.

WATCHWORK.

Review of a Treatise on "Watchwork, Past and Present." By Rev. H. L. Nelthropp, M.A., F.S.A. With illustrations. London. E. and F. N. Spon, 48, Charing Cross; New York: 446, Broome Street. 1873.

This is a very readable and thoroughly practical work, which aims at filling what the author deems a gap in our technological literature. The general scope and intentions of the author are thus set forth in the preface:—

During the last century, very many books were printed giving excellent information on the making of clocks and watches—more particularly in French—but all these works have become extremely scarce, and, as a matter of course, expensive, far beyond the means of ordinary persons to buy the same.

The present treatise is designed to supply the deficiency by putting it within the power of all to obtain information at a trifling cost.

Perhaps it may be urged that the subject is not of sufficient interest to induce many to give any time to its study—from this I beg to differ.

In an archæological point of view, it deserves to be studied. Is it not absurd for persons to visit the South Kensington or other museums deficient in the knowledge of a subject of which there are so many fine examples exhibited? Of what use the many watches of every date, size, and style, when the looker-on can only exclaim, here is a watch! or is indebted to the printed label for information? How is it possible for even educated men to feel any interest in the exhibition of articles of vertu, if they have never read, or marked, or learnt for themselves the history, the theory, and practice which have made all these objects so much prized and sought after?

Besides, if there is an indescribable pleasure felt by every individual, no matter of what degree, in becoming the possessor of a good going watch, surely that pleasure ought to be enhanced by being able to give a satisfactory reason for the working of the little machine which is carried daily in the pocket. Will then, men, who are proud of their knowledge, remain satisfied to be considered the mere porters of an article sold to them by a dealer for a purpose? and which is well or ill-repaired according to the honesty of any jobber employed at random, for it is calculated as a certainty that the possessor lacks the needful knowledge which would make him able to appreciate the really scientific workman.

It may be safely stated that were we to go to our universities or public schools, scarcely half-a-dozen youths could be found who know a single thing beyond the fact that they had a watch given them; that they were told it was a lever; that it goes badly; and is always requiring something or other. Why should this ignorance prevail in this age of universal knowledge?

It is useless to deny that the study of watchwork presents many difficulties, the principal one being this, that it is not easy to obtain the practical information without which theory is in a great measure rendered valueless.

As a rule, watchmakers are not desirous of imparting any information respecting their business; and the dealers know little or nothing beyond the mere necessary knowledge required to carry on their branch of the trade. The student is then apparently arrested at first starting; but it need not be so, for to meet this difficulty I have in this treatise *defined* all the terms used *in the trade*; and I have further furnished drawings adapted to show the working of the escapements.

The knowledge thus given has taken a long time to acquire; and I have by perseverance obtained my information in Switzerland, France, and England. In each country I have visited establishments whose proprietors were willing to answer inquiries, and who felt an interest in the well-doing of their trade, without exacting that a footing should be paid by the purchase of a costly timekeeper.

Without some occasional assistance from practical business men, it is scarcely possible for any ardent lover of the art, or well-wisher of the trade, to do justice to a subject by a mere acquaintance with the statements which have appeared in books.

In the hope of rendering my work more complete, I have in the *Appendix* given a translation of M. de Lalande's very excellent treatise on the pitching of wheels and pinions, in which he has laid down everything which is requisite to constitute a perfect pitching.

This treatise by M. de Lalande is extremely interesting, as it was written for the express purpose of simplifying the subject, and bringing it within the intellectual capacity of persons brought up to the clock and watch trade; and who possibly would not have been able to take an interest in any over-learned arguments.

It appeared in Lepaute's treatise on clockwork, 1767, a book which Moinet, "Traité générale d'Horlogerie," says was "reviewed, revised, and augmented by the celebrated Lalande himself."

The student anxious for more information on this branch of the subject is referred to Professor Willis's valuable work on the "Principles of Mechanism," 1870, in which the teeth of wheels, trains, &c., are fully discussed.

In fulfilment of his views and intentions in writing this work, our author, in distinct chapters, treats of Words and Terms used in Watchwork; Tools required for Watchwork; Time; Historical Summary to the End of the Fifteenth Century—from A.D. 1500 to the Present Time; on Calculations of the Numbers for Wheels and Pinions, their Proportional Sizes, Trains, &c.; of Dial-wheels or Motion Work, Length of Time of Going without Winding up; the Verge; Horizontal, or, more correctly, Cylinder Watch; the Duplex; the Lever; the Chronometer, or Detached Escapement; Repeating Watches; Keyless Watches, the Pendulum, or Spiral Spring; Compensation; Jewelling of Pivot-holes; Clerkenwell; Fallacies of the Trade; Incapacity of Workmen, How to choose and use a Watch; and gives an Appendix and Index.

Perhaps the following may prove as interesting as any portion of the work:—

Keyless Watches. At the commencement of the present century watches, provided with a mechanism which would cause winding without a key, were looked upon with no great favour, and considered mere articles of fancy. A watch can possess no greater defect than to have too many separate pieces in its interior works, consequently it could hardly have been conjectured that keyless watches would have become, as at the present day, quite the fashion, and the mechanism be applied even to cheap Swiss goods, price £2 10s. It is said that the Emperor Napoleon I. possessed a self-winding watch, which was arranged something like a pedometer that at every step he took a weight acted on the end of a lever having a weak spring under it, which was attached to a click working into a ratchet wheel in the barrel arbor, and so wound up the main-spring. One method out of many employed in keyless watches to accomplish the winding is as follows (here the book has an illustrative figure which the description refers to, and we follow this as near as denudation of the letters of reference permits):—The construction comprises a square piece of steel with two short arms, and a steel cap, which is screwed down nearly tight into it, a portion being cut out for its reception. The screw forms also the axis of a wheel. The steel piece moves slightly to the left. Another wheel (small) gears with the wheel first mentioned, and also a wheel set on the barrel-arbor; a click prevents this wheel running back. The minute wheel is constructed pitching into canon-pinion. The hour wheel pitching into minute pinion. On the second arm of steel piece is a steel wheel which by means of a push piece is caused to gear into the minute wheel, and at the same time discharge the small wheel (the second one above mentioned) from the wheel thirdly mentioned. A spring is so placed as to keep the steel piece to its exact position for the winding. In the pendant is an axis carrying at the end an oblique bevelled wheel which plays into the wheel first mentioned. The action is this: If the button or handle of the watch be turned to the left the wheel first mentioned will revolve, causing the wheel secondly mentioned to go round, and so put in motion the wheel set on the barrel-arbor, and winding up the main-spring. If a small knob at the side of the watch case be pressed in then the wheel thirdly mentioned will gear with the proper wheel, and the hands may be set to time. The whole of this motion work lies under the dial.

LIFE OF MRS. SOMERVILLE.

"Personal Recollections, from Early Life to Old Age, of Mary Somerville;" with selections from her Correspondence. By her Daughter, Martha Somerville. London: John Murray, Albemarle-street. 1873.

Here is a work that cannot fail to be highly esteemed; for the life of Mrs. Somerville will have interest alike for the scientific and the general reader, and must be received with especial favour by all who deem the advancement of "Women's rights," as they are termed, part of the programme of progress in the present period of civilization.

Mrs. Somerville, like the venerable and respected Mr. Cornelius Varley, whose decease we lately chronicled in the pages of this journal, was one of those few intellectual veterans whose long lives have carried them on to times far removed from the period when their fame-compelling works were performed, and to an epoch in their existences when their energies cease to have sufficient power to keep up the same measure of activity, which their previous triumphs in the intellectual arena have made the high standard of their capabilities.

In the case of Mrs. Somerville, however, the public interest will not be limited to the consideration of her character as one eminent for intellectual power, for, as an example of the high state of mental culture a woman may attain to, and yet retain all that is estimable and pleasurable in woman's character, she stands pre eminent. The story of her life, as told in the volume before us, is simply and naturally told, principally in her own words, and it introduces us to many reminiscences of men and manners of her earlier days, the former being generally of high position in science, letters, and politics.

At the present day it may not be out of place to remark that the mementoes of the scientific attainments of Mrs. Somerville are to be found in her "Mechanism of the Heavens," "Connection of the Physical Sciences," "Physical Geography," "Molecular and Microscopic Science;" but it is the general view of her character that we will now present to our readers.

Born in the year 1780 as a daughter of a naval officer (afterwards Sir William Fairfax), who was constantly away from home engaged in fighting the battles of his country, she had no educational advantages beyond the average of those common to Scottish gentlewomen of the period, and that these were very meagre her recollections testify; so that the extent of the aid she received in her career of intellectual progress was of very small account indeed; and not only so, but, as her daughter states, she lived amongst

persons who took no interest in the studies which proved attractive to her, and who disapproved of her devotion to pursuits so different from those of ordinary young girls at the end of the last century, especially in Scotland, which was far more old-fashioned and primitive than England.

Her simple account of her early days is not without interest, bringing us acquainted with her as a lonely child wandering by the seashore, and on the links of Burntisland, collecting shells and flowers; or spending the clear, cold nights at her window, watching the starlit heavens, whose mysteries she was destined one day to penetrate in all their profound and sublime laws, making clear to others that knowledge which she herself had acquired, at the cost of so hard a struggle.

It was, it appears, not only in her childhood and youth that her studies encountered disapproval. Not till she became a widow had she perfect freedom to pursue them. The first person—indeed the only one in her early days—who encouraged her passion for learning was her uncle by marriage, afterwards her father-in-law, the Rev. Dr. Somerville, minister of Jedburgh, a man very much in advance of his century in liberality of thought on all subjects. He was one of the first to discern her rare qualities, and valued her as she deserved; while through life she retained the most grateful affection for him, and confided to him many doubts and difficulties on subjects of the highest importance. Her daughter (the authoress of this volume) adds the following:—Nothing can be more erroneous than the statement, repeated in several obituary notices of my mother, that Mr. Greig (her first husband) aided her in her mathematical and other pursuits. Nearly the contrary was the case. Mr. Greig took no interest in science or literature, and possessed in full the prejudice against learned women which was common at that time. Only on her marriage with my father, my mother at last met with one who entirely sympathised with her, and warmly entered into all her ideas, encouraging her zeal for study to the utmost, and affording her every facility for it in his power. His love and admiration for her were unbounded; he frankly and willingly acknowledged her superiority to himself, and many of our friends can bear witness to the honest pride and gratification which he always testified in the fame and honours she attained.

No one can escape sorrow, and my mother, in the course of her long life, had her full share, but she bore it with that deep feeling of trust in the great goodness of God which formed so marked a feature in her character. She had a buoyant and hopeful spirit, and though her affections were very strong, and she felt keenly, it was ever her nature to turn from the shadows to all that is bright and beautiful in mortal life. She had much to make life pleasant in the great honours universally bestowed upon her; but she found far more in the devoted affection of friends, to say nothing of those whose happy lot it has been to live in close and loving intercourse with so noble and gentle a spirit.

She met with unbounded kindness from men of science of all countries, and most profound was her gratitude to them. Modest and unpretending to excess, nothing could be more generous than the unfeigned delight she showed in recognising the genius and discoveries of others; ever jealous of their fame, and never of her own.

It is not uncommon to see persons who hold in youth opinions in advance of the age in which they live, but who at a certain period seem to crystallise, and lose the faculty of comprehending and accepting new ideas and theories; thus remaining at last as far behind, as they were once in advance of public opinion. Not so my mother, who was ever ready to hail joyfully any new idea or theory, and to give it honest attention, even if it were at variance with her former convictions. This quality she never lost, and it enabled her to sympathise with the younger generation of philosophers, as she had done with their predecessors, her own contemporaries.

Although her favourite pursuit, and one for which she had decidedly most aptitude, was mathematics; yet there were few subjects in which she did not take interest, whether in science or literature, philosophy or politics. She was passionately fond of poetry, her especial favourites being Shakespeare and Dante, and also the great Greek dramatists, whose tragedies she read fluently in the original, being a good classical scholar. She was very fond of music, and devoted much time to it in her youth, and she painted from nature with considerable taste. The latter was, perhaps, the recreation in which she most delighted, from the opportunity it afforded her of contemplating the wonderful beauty of the world, which was a never-failing source of intense enjoyment to her, whether she watched the changing effects of light and shade on her favourite Roman Campagna, or gazed, enchanted, on the gorgeous sunsets on the bay of Naples, as she witnessed them from her much-loved Sorrento, where she passed the last summers of her life. All things fair were a joy to her—the flowers we brought her from our rambles, the sea-weeds, the wild birds she saw, all interested and pleased her. Everything in nature spoke to her of that great God who created all things, the grand and sublimely beautiful as well as the exquisite loveliness of minute objects. Above all, in the laws which science unveils step by step, she found ever renewed motives for the love and adoration of their Author and Sustainer. This fervour of religious feeling accompanied her through life, and very early she shook off all that was dark and narrow in the creed of her first instructors for a purer and a happier faith.

It would be almost incredible were I to describe how much my mother contrived to do in the course of the day. When my sister and I were small children, although busily engaged in writing for the press, she used to teach us for three hours every morning, besides managing her house carefully, reading the newspapers (for she always was a keen, and, I must add, a liberal politician), and the most important new books on all subjects, grave and gay. In addition to all this, she freely visited and received her friends. She was, indeed, very fond of society, and did not look for transcendent talent in those with whom she associated, although no one appreciated it more when she found it. Gay and cheerful company was a pleasant relaxation after a hard day's work. My mother never introduced scientific or learned subjects into general conversation. When they were brought forward by others, she talked simply and naturally about them, without the slightest pretension to superior knowledge. Finally, to complete the list of her accomplishments, I must add that she was a remarkably neat and skilful needlewoman. We still possess some elaborate specimens of her embroidery and lace-work.

Devoted and loving in all the relations of life, my mother was ever forgetful of self. Indulgent and sympathising, she never judged others with harshness or severity; yet she could be very angry when her indignation was aroused by hearing of injustice or oppression, of cruelty to man or beast, or of any attack on those she loved. Rather timid and retiring in general society, she was otherwise fearless in her quiet way. I well remember her cool composure on some occasions when we were in great danger. This she inherited from her father, Admiral Sir William Fairfax, a gallant gentleman who distinguished himself greatly at the battle of Camperdown. Sir William was the son of Joseph Fairfax, Esq., of Bagshot, in the county of Surrey, who died in 1793, aged 77, having served in the army previous to 1745. It is understood that his family descended from the Fairfaxes of Walton, in Yorkshire, the main branch of which were created Viscounts Fairfax of Emly, in the peerage of Ireland (now extinct), and a younger branch Barons Fairfax of Cameron, in the peerage of Scotland. Of the last-named was the great Lord Fairfax, Commander-in-Chief of the armies of the Parliament, 1645—50, whose title is now held by the eleventh Lord Fairfax, a resident in the United States of America.

These recollections are principally matter noted down by Mrs. Somerville herself, containing statements of incidents in her life, with her reflections upon them; they therefore leave little opportunity for selecting quotations, which could be readily made available for our pages. Suffice it to say, that the work contains many interesting notices relative to such men as Sir Walter Scott, Boulton and Watt, the Herschells, Arago, Cuvier, Delaplace, Humboldt, Lord Brougham, Faraday, and occasionally introduces us to celebrities of the political, artistic, and literary world of the generations just passed and now passing away. In short, the reader of this book will enjoy a chit-chat with a scientific personages of the highest intellectual attainments, who will not weary him with scientific preachments, but will afford him pleasant pastime, which will be none the worse because it is capable of being turned to mental profit.

The following extracts will show that the experiences of everyday life are interspersed with notanda pertinent to the world of science; indeed, as before intimated, the work is as pleasurable for the general reader as it is interesting to those of a scientific turn of mind. Speaking of her girlhood, Mrs. Somerville says:—They sent me to Strange's dancing school. Strange himself was exactly like a figure on the stage; tall and thin, he wore a powdered wig with cannons at the ears, and a pigtail; ruffles at the breast and wrists, white waistcoat, black silk or velvet shorts, white silk stockings, large silver buckles, and a pale blue coat completed his costume. He had a little fiddle on which he played called a kit. My first lesson was how to walk and make a curtsey. "Young lady, if you visit the Queen, you must make three curtsies, lower and lower, and lower, as you approach her. So-o-o"—leading me on and making me curtsey. "Now, if the Queen were to ask you to eat a bit of mutton with her, what would you say?" In fact, much of the book is occupied with this kind of pleasant chit-chat, though such passages as the following, which refers to the important spectrum discoveries, is a sample of portions of the work by no means few or far apart:—

One bright morning Dr. Woolaston came to pay us a visit in Hanover-square, saying, "I have discovered seven dark lines crossing the solar spectrum, which I want to show you." Then, closing the window shutters so as to leave only a narrow line of light, he put a glass prism into my hand, telling me how to hold it. I saw them distinctly. I was among the first—if not the very first—to whom he showed the lines, which were the origin of the most wonderful series of cosmical discoveries, and have proved that many of the substances of our globe are also constituents of the sun, the stars, and even of the nebulæ.

But these memoirs are not restricted to notices of home-life, or to scientific notes; they abound with reminiscences of eminent personages of all kinds, of which the following is an example:—Sir Sydney Smith was still in Paris trying to renew the Order of Knights Templars. Somerville and I went with him one evening to a reception at the Duchesse d'Abrantès's, widow of Junot. She was short, thick, and not in the least distinguished-looking, nor in any way remarkable. I had met her at the Duchesse de Broglie's, where she talked of Junot as if he had been in the next room. Sir Sydney was quite covered with stars and crosses, and I was amused with the way he threw his cloak

back to display them as he handed me to the carriage.

We could amuse ourselves by picking out plenty of such pleasant bits of memorials of past days, but we think we have done enough to show our readers what pleasure and profit may be obtained by the perusal of this work.

ELEMENTARY CHEMISTRY.

"An Easy Introduction to Chemistry." Edited by the Rev. ARTHUR RIGG, M.A., late Principal of the College, Chester. Rivingtons. London, Oxford, and Cambridge. 1873.

MOST works on chemistry now issued from the press are for the purpose of instruction only where the usual formula are given, and various equations understandable and necessary to the student are stated. Then there are others which are written exclusively for those advanced in the study of chemistry to its highest branches. But last, and by no means least, there is that class of works which are designed not only for the purpose of imparting a solid but simple view of the science, but also to serve as a book of useful information for both the scientific and the unscientific reader. Of this last class the work under notice is an example, and we think that its contents will be read with pleasure by the young and old alike, to whom it will be a source of profitable instruction. According to the editor's preface, the work "is based upon a 'First Book of Chemistry,' by Dr. Worthington Hooker, published in America, and is intended to convey information in respect to changes which are likely to attract the attention of young persons who observe and inquire. The book professes to be only an introductory one, but," as the editor rightly observes, "may, however, quite consistently be an interesting and accurate one;" and we think all this has been effected, and that the incentive to progress in chemical knowledge afforded by this work bids fair to lead all who use it to make further inquiries and deeper research into the science of chemistry.

The book is written in clear, intelligible, and simple language, and the various experiments are described and illustrated in a way that will render the work of peculiar service to the young student. In the way of illustration, we cannot do better than give the following extract:—

Persons are sometimes injured by charcoal being burnt in a close room, and even death is occasioned. It is the carbonic gas produced by a union of carbon in the charcoal with oxygen in the air that causes this. Hence, you see, charcoal never ought to be burnt except in the open air or in a room in which doors and windows are open, or in fireplaces where the chimney supplies a way by which the carbonic gas can escape. You see, too, what remedy to apply if any one be poisoned by gas from burning charcoal. It is to open doors and windows to let fresh air enter. Remember, that doors must be opened as well as windows, for air must come along the floor to drive out the gas.

If a grown-up person and a child are in a room where charcoal is burned in an open furnace, the child will be affected first, because its mouth is so much nearer the floor than the mouth of the adult.

QUALITATIVE BLOW-PIPE ANALYSIS.

"Elderhorst's Manual of Qualitative Blow-pipe Analysis and Determinative Mineralogy." Edited by HENRY B. NASON, Ph.D., Rensselaer Polytechnic Institute, Troy, N. Y., and CHARLES F. CHANDLER, Ph.D., Columbia College School of Mines, New York. Philadelphia and London. T. Ellwood Zeel.

BY the title page of this work, we are informed that it is a fourth edition, and we may therefore reasonably infer that on the other side of the Atlantic it is a work of recognised merit; and, although not professing to be deeply versed in this branch of science, yet our knowledge does enable us to say that the work is a very serviceable and reliable one. In this edition there have been added various and necessary alterations and amendments, which we think would be of service to the persons using the work, and enhance its value. But we think that as the editors have considered it necessary to introduce amongst other matter a short statement in reference to spectrum analysis, it would have been as well had they given a more complete statement than they have done. However, the work is one that may be relied on for correct and excellent information, and as such we commend it to our readers.

GENERAL SCIENCE.

"Darwinism and Design." By GEORGE ST. CLAIR. Hodder and Stoughton.

THIS is an attempt to make the religious views of the Darwinian theory fit in with the creation of man, that is, although man is the product of evolution, yet, every here and there, Divine interference shows the work of a superintending designer

"Contributions to Solar Physics." By J. N. LOCKYER. Macmillan and Co.

We are not in a position to do more than notice the publication of this work.

"Geology." By ARCHIBALD GEIKIE, LL.D. Macmillan and Co.

THIS is a "Science Primer," which will be found useful in elementary tuition.

MECHANICAL TEXT-BOOK.

"A Mechanical Text-book; or, Introduction to the Study of Mechanics and Engineering." By W. MACQUORN RANKINE, C.E., and E. F. BAMBER, C.E. Griffin and Co.

As might be expected from any work with which the late lamented Professor Rankine had anything to do, this is a high-class production. It is, however, open to some objection, on the ground that either too much or too little mathematical lore is introduced. As a rule, elementary works in the experimental sciences should require no more than the merest elementary knowledge of mathematics in the students using them; but this work is mathematical to an extent far beyond the tyro's mark, and, at the same time, it does not reach that of the professed mathematician's. However, the book is a very useful and valuable work, and as such we commend it to our readers.

TRADE SERIALS.

"The Furniture Gazette: an Illustrated Journal treating of all Branches of Cabinet Work, Upholstery, and Interior Decoration." New series.

THIS journal, which deals with all matters relating to the internals of building, so to speak, is still supplying the trade and connoisseurs with valuable information.

THE NATURALIST IN NICARAGUA.

"The Naturalist in Nicaragua, with Observations on Animals and Plants." By THOMAS BELT. Murray.

THIS valuable yet unpretentious volume, by one who may well be considered an authority upon any subject on which he speaks, cannot fail to interest a large section of the reading public, besides those who are engaged in scientific investigations.

THE "WRITING-BALL."—The Emperor of Austria has just conferred the medal Pro Literis et Artibus on the inventor, Mr. Malling-Hansen, and the manufacturer, Mr. Jurgensen, of Copenhagen, for the ingenuity and utility shown in the invention and manufacture of this useful instrument, which was exhibited at the Vienna Exhibition.

ON AUTOMATIC RAILWAY CARRIAGE COUPLINGS.

BY W. GADD, ESQ., C.E., MANCHESTER.

In this paper, read at the Inventors' Institute, on 11th December last, the author, after referring to the importance of the subject, and to various failures in providing a satisfactory system of railway couplings, proceeded as follows:—

The essentials of success, or, in other words, the problem to be solved, I conceive to be as follows—first, that the coupling of the carriages must take place automatically by gentle collision. Second, that the operation of uncoupling should be easy, and performed from some convenient part of the carriages, avoiding the necessity of the operator going between them. Third, that the apparatus should be simple in construction and in action, having few and strong parts, and adaptable to the present design of carriage; and, fourth, it is of the first importance that the construction of the coupling should be such that the apparatus will be exactly alike at each end of the carriage, that is to say, there must be no right and left coupling, or front and back coupling as such, but the carriages should couple from either end of one carriage to either end of another. I also think it would be a further advantage if, combined with these conditions, the couplings had such a construction that, in the event of an engine or carriage leaving the metals, or jumping the same, such engine or carriage should have a tendency to disengage itself from the rest of the train, which would then have a better chance of keeping the line.

Mr. Chairman and Gentlemen, I now propose explaining to you a method of coupling which, I believe, will fulfil the whole of the requirements or conditions I have just laid down. This method is now becoming known as "Green's Automatic Coupling," and is the invention of Mr. William Green, an architect, residing in the town of Hyde, in the county of Cheshire.

I have prepared a rough sketch of the method on a scale which I trust will enable you to follow my explanations with ease.

This coupling consists, as you will perceive, of a radial hook, of wrought iron, and of rather peculiar construction. It is jointed by means of a strong pin joint, to the draw bar, which draw bar is constructed with a head for jointing purposes, instead of the usual hook. It will thus be seen that the line of the hook's movement is lateral, and is held in position by means of the spring. In this case a plate spring is shown, but a helical or any suitable form of spring may be used, or the hook may be held in position by means of a weight. The peculiarity of the hook's construction is its breadth, the object of which I will explain further on.

This radial, held in a position and up to a stop, by suitable means, is all that is necessary for coupling, the rest of the apparatus being for disengaging purposes, the arrangement and detail of which may be varied to almost any extent. You will please observe that if a radial hook in this position is placed at each end of a carriage, the mere fact of turning that carriage round reverses the position of the coupling [illegible], so that two carriages meeting with either ends would form an interlocking coupling. This will be better seen and understood practically by reference to the working model which I will submit to your inspection at the close of my remarks on the subject. It will then be apparent that this result is due to the position of the coupling hook solely, and to its taking a [illegible] or lateral motion.

When the two hooks come in contact with each other, they strike the outer [illegible], and so force each other asunder, and when the requisite degree of tension in the buffer-springs is obtained, the hooks engage each other. The length of the hook is [illegible]

to cause the required tension on the draw-bar, and thus ensure regularity of tension throughout the train, and uniformity of tension at all times to the same carriage, or, if it is thought desirable to have varying tensions for varying lengths and weights of trains, a shortening draw-bar may be provided, which could be operated upon from the side of the carriage by means of a shaft with worm and wheel, or by screw or other action. The line of movement taken by the hook upon the pin-joint or fulcrum being lateral, the coupling readily accommodates itself to any curve which may present itself either in one direction or the other. For, although on one side the hook is held up to a dead stop, beyond which it cannot turn, yet it may always be turned in the opposite way against the spring; and, as two couplings of this description, constructed alike, when brought into juxtaposition are relatively reversed, it naturally follows that one is free to turn in one direction and the other in the opposite.

The method here shown of unlocking is as follows: the operator stands on the step of the carriage, near the end thereof, or it may be on a platform, so that disengagement can be effected either during motion or not. He takes hold of the lever handle E, and pulls the same towards him, when disengagement takes place by means of the rod H, attached by pin joint at one end to the large lever E, and at the other to the end of the small lever I, which turns upon the same fulcrum as the radial hook A. On this same hook A, and near the fulcrum, is a projection or pin K, against which the small lever I presses as it is pulled forward, whereby the radial hook is forced backward, and so disengaged from a corresponding hook on the other carriage. The hook can be locked in this open state, or allowed to return to the original position ready to couple itself with any carriage that may be prepared for contact therewith. It will be easily understood that disengagement can be effected from either carriage, and, as the uncoupling apparatus of one end of the carriage is placed on one side, and that of the other end on the other side, it necessarily follows that the operation of uncoupling may be performed from whichever side of the train happens to be convenient. In the model which I shall have the honour to place before your notice, there are modifications of the method of uncoupling which may be multiplied almost indefinitely without departing from the principle laid down, namely, that of coupling by means of a sideway hook having a lateral motion, and attached to the drawbar, or end of the carriage. The radial hook is made seven inches wide or deep, so that any ordinary jumping of the carriages will not disengage the same by allowing the hooks to lift over one another; but if by any accident more than the width of the hook is jumped by a carriage, disengagement at that spot takes place. Of course the width of the hook may be six, seven, eight, or nine inches, or any width which shall be found most reliable in practice. This tendency to become disengaged under extraordinary circumstances, I take to be of great value and importance, for how often has it occurred when an engine or a carriage has left the line, and, we will say, gone down an embankment, that it has dragged the greater portion of the train in its wake, whereas, if the coupling had been of the character just described, the damage would have been, most probably, confined to that engine or carriage which first left the track.

It thus appears that this method of coupling fully complies with the conditions I [illegible] laid down, namely, the carriages [illegible] by gentle collision. The [illegible] of uncoupling is performed from [illegible] part of the carriage, and [illegible] in motion or not. I may here state that it is [illegible] question of detail to cause the uncoupling to take place from the inside, or any part of the carriage. In the case of the guard's break-van, an inside apparatus would of course be used, so as to enable a portion of the train to be slipped by the same form of coupling, for which purpose a special kind has now to be used. The apparatus shown is strong and simple (especially the coupling hook itself), both in action and construction. It has few parts, and can be applied to carriages now in use without much change in the parts, except those portions which are entirely substituted. And what is of the greatest importance, it is identical in construction at both ends of a carriage, making it of no moment from which end of the carriage coupling takes place. Perhaps the greatest drawback to its rapid introduction is the varying height of the rolling stock on some of our railways. But this is a great evil in itself, and, doubtless, one source of danger, so that a system of coupling which would compel something like uniformity in this respect alone, would be a great gain.

Perhaps I may be allowed to state before closing my remarks on this subject, that the invention is being carried out under my own supervision as regards the conducting of experiments, negotiations, &c.

In conclusion, I trust that I have made this matter clear to your understandings, and that the invention has suffered nothing from my explanations

SINGLE RAIL.

AMERICAN papers notice the completion recently, at a machine shop in Gloucester, New Jersey, of a four-ton locomotive, or steam velocipede, resting upon two wheels, one following the other, and designed to run on one rail. The rail or track upon which it is to run, a sample of which is laid in the yard of the builders, is styled a "Prismoid, or one-track railway," and is composed of several thicknesses of plank, built up in the style of an inverted keel of a vessel, with a flat rail on the apex. Upon a trial a speed of about 23 miles an hour was attained, and the inventor and patentee claims that the speed can be almost doubled on a lengthened track. The track upon which the trial was made contained 30ft. of lumber and 18lb. of iron to the lineal foot, proving itself equal to a span of 20ft., remaining firm and unyielding under the pressure of the engine as it traversed the road. The revolving flanges attached to the engine and which run on the outside of each wheel, it is said, absolutely lock the rolling stock to the prism, and obviate the necessity of so much heavy rolling stock in light traffic at a high rate of speed. It is also claimed that a prismoidal railway, built with a base of 14 inches, angles 45 degrees, can be built at a cost of $3,000 per mile. The inventor is of opinion that his engine and track are particularly adapted for the propelling of canal boats. The engine was to be shipped to Atlanta, Georgia, where it goes into operation on a street railroad, built at an elevation of 12ft. above the side walk.

UNIVERSAL PATENT LAWS.

"The true basis of all legislation"—said Dr. Haseltine at the Vienna Patent Congress —"is universal justice; and fortunately for the objects of this Congress, justice to inventors of all nations accords with the highest national interests. The more complete the justice to inventors without regard to state boundaries, the greater the ultimate advantage to the nation. The recognition of this principle is essential to all equitable patent legislation and an indispensable condition of the assimilation of the patent laws of nations, which assimilation upon a liberal basis will remove the valid objections to existing systems and will secure to inventors an adequate compensation for their inventions. This assimilation made possible by the influence of modern inventions upon the political relations of states will annihilate the opposition to isolated patent systems, and tend to unite nations in the bonds of universal brotherhood.—The proposition to assimilate these systems is no new invention, though it has been reserved to this Congress to inaugurate the coveted reform by a public declaration of the cardinal principles of a general system. The eminent Director of the British Patent Office made a similar proposition seventeen years ago to the Royal Commissioners of Patents, and visited the chief European States to arrange plans for an assimilation of the various patent systems, and his suggestions were favourably received by the authorities. The Select Committee of the British House of Commons has recommended this assimilation, and the most earnest advocate of 'free trade in inventions' on that Committee was the first to urge immediate action in this matter upon British Ministers who have taken the first step towards assimilation by the collection and publication of the various patent laws and regulations. The President of the United States has accredited a delegate to this Congress, while other Rulers have expressed their interest in the object of our deliberations.—The spirit of the age is favourable to success, and by wise counsel we may do more for the material interests of mankind than any Congress of modern times, but the real work will commence when our labours have ended.—The price of every great and beneficent reform is continued agitation, which, in time, creates public opinion, the supreme ruler in all liberal Governments, of which opinion the Press is the educator and the organ by whose aid we may reasonably hope in our generation to secure equitable patent systems, uniform in principle and co-extensive with civilization."
—*The Cosmopolitan.*

THE VITRIFIED FORT ON THE BARMEKYNE OF ECHT, ABERDEENSHIRE.

AT a distance of about twelve miles from Aberdeen, about a mile to the north-west of the village of Echt, and lying between the Echt and Skene turnpikes, lies the Barmekyne of Echt, a prettily wooded hill, which has been long associated with pic-nic parties, and which contains near its summit the remains of a vitrified fort.

A few remarks respecting it may not be uninteresting.

Near the summit of the hill are two, what may be called, concentric circles of stones, for the outer line of stones seems to be a circle, and the inner one, if not a circle, is a polygon. Those two circles lie the one within the other, at a distance of about 9 or 10 yards from each other. The diameter of the inner circle is probably about 100 yards, while that of the outer one is about 120. They are joined together at various points by connecting walls. Thus, at the south-west part of the fort a couple of walls connect the two concentric walls, so as to form a passage between them, and likewise extend to a considerable distance beyond the outer wall. Again, they are connected by a single wall at the south side of the fort, and about 17 yards to the eastward by another single wall. Likewise at the south-east part of the fort the concentric walls are joined by two walls, forming a sort of passage between them, and extending a considerable distance beyond the outer wall. The breadth of the inner wall, as it stands, is about 15 feet at the base, but the stones of it having been very much knocked down, 6 feet would probably be the outside limit of its breadth at its base as it originally stood.

The breadth of the outer wall, as measured at one part, is about 4½ feet at about 3 feet from the ground. It is difficult, however, to determine the exact height of a particular stone above the real base of the wall, inasmuch as the ground at both sides of the wall is in many places raised by stones covered

with turf. The outer wall is much more entire than the inner one, but it is much smaller. The stones of the walls, which are very much overgrown with vegetation, vary in size, some being large boulders, while others are not larger than a man's hand.

There seem to have been other walls or fortifications besides the two mentioned above, but these being beyond the two specified, and further down the hill, and being considerably enveloped in wood, and being, moreover, at least in one part, considerably overgrown with moss and turf, are not nearly so conspicuous as the two previously alluded to.

TUNNEL BETWEEN ENGLAND AND FRANCE.

On Tuesday, December 9th, 1873, at the Institution of Civil Engineers, T. Hawksley, Esq., President, in the chair, a paper "On the Geological Conditions affecting the Construction of a Tunnel between England and France," was read by Mr. Joseph Prestwich, F.R.S., F.G.S., Assoc. Inst. C.E.

The author, in this paper, reviewed the geological conditions of all the strata between Harwich and Hastings on one side of the Channel, and between Ostend and St. Valery on the other side, with a view to serve as data for any future projects of tunnelling, and to show in what directions inquiries should be made. The points considered were the lithological characters, dimensions, range and probable depth of the several formations. The London clay, at the mouth of the Thames, was from 200 feet to 400 feet thick, while under Calais it was only 10 feet, at Dunkirk it exceeded 264 feet, and at Ostend it was 448 feet thick. He considered that a trough of London clay from 300 feet to 400 feet, or more, in thickness, extended from the coast of Essex to the coast of France, and, judging from the experience gained in the Tower Subway, and the known impermeability and homogeneity of this formation, he saw no difficulty, from a merely geological point of view, in the construction of a tunnel, but for the extreme distance—the nearest suitable points being 80 miles apart. The lower tertiary strata were too unimportant and too permeable for tunnel work. The chalk in this area was from 400 feet to 1,100 feet thick; the upper beds were soft and permeable, but the lower beds were so argillaceous and compact as to be comparatively impermeable. In fact, in the Hainaut coal fields they effectually shut out the water of the water-bearing Tertiary strata from the underlying coal measures. Still, the author did not consider even the lower chalk suited for tunnel work, owing to its liability to fissures, imperfect impermeability, and exposure in the Channel. The Gault was homogeneous and impermeable, but near Folkestone it was only 130 feet thick, reduced to 40 feet at Wissant, so that a tunnel would hardly be feasible. The lower green sands, 260 feet thick at Sandgate, thinned off to 50 feet or 60 feet at Wissant, and were all far too permeable for any tunnel work. Again, the Wealden strata, 1,200 feet thick in Kent, were reduced to a few unimportant rubble beds in the Boulonnais. To the Portland beds the same objections existed as to the lower green sands, both were water-bearing strata. The Kimmeridge clay was 360 feet thick near Boulogne, and no doubt passed under the Channel, but in Kent it was covered by so great a thickness of Wealden strata as to be almost inaccessible; at the same time it contained subordinate water-bearing beds. Still, the author was of opinion that, in case of the not improbable denudation of the Portland beds, it might be questionable to carry a tunnel in by the Kimmeridge clay on the French coast, and out by the Wealden beds on the English coast. The oolitic series presented conditions still less favourable, and the lower beds had been found to be water-bearing in a deep Artesian well recently sunk near Boulogne. The experimental deep boring now in progress near Battle would throw much light on this part of the question.

The author then passed on to the consideration of the Palæozoic series, to which his attention was more particularly directed while making investigations, as a member of the Royal Coal Commission, on the probable range of the coal measures under the South East of England. The author, therefore, considered that it would be perfectly practicable, *so far as safety from the influx of the sea water was concerned*, to drive a tunnel through the Palæozoic rocks under the Channel between Blanc Nez and Dover, and he stated that galleries had actually been carried in coal, under less favourable circumstances, for 2 miles under the sea near Whitehaven. But while in the case of the London clay the distance seemed almost an insurmountable bar, here again the depth offered a formidable difficulty. As a collateral object to be attained, the author pointed to the great problem of the range of the coal measures from the neighbourhood of Calais in the direction of East Kent, which a tunnel in the Palæozoic strata would help to solve. These were, according to the author, the main conditions which bore on the construction of a submarine tunnel between England and France. He was satisfied that on geological grounds alone, it was in one case perfectly practicable, and in one or two others it was possibly so; but there were other considerations besides those of a geological nature, and whether or not they admitted of so favourable a solution was questionable. In any case, the author would suggest that, the one favourable solution admitted, it might be desirable, in a question involving so many and such great interests, not to accept an adverse verdict without giving all those considerations the attention and deliberation which the importance of the subject deserved.

Granting the possibility of the work in a geological point of view, there were great and formidable engineering difficulties; but the vast progress made in engineering science during the last half century, led the author to imagine that they would not prove insurmountable, if the necessity for such a work were to arise, and the cost were not a bar.

The Franklin Institute of Philadelphia, considering the want of certainty and accuracy existing in the science of dynamics, have appointed a Committee "for the purpose of establishing precision in the meaning of dynamical terms, and to select and approve such terms as may be found proper, and reject those which they consider unnecessary."

Under the title of "The Conservation of Energy," by Professor Balfour Stewart, Messrs. H. S King and Co. publish a valuable elementary work, equally suitable for junior students as for those who are wholly unacquainted with the subject with which it deals.

An admirable paper, "On the Jade of the Kuenlun Mountains," has been communicated to the Academy of Science of Munich by Hermann von Schlagintweit, and published in the *Sitzungsberichte* of the Academy. The author visited the quarries on the Kara kash river, which formerly supplied the Chinese with much of their jade. It may be remembered that these quarries were popularly described some time ago by Dr. Cayley. Although the title of Schlagintweit's paper refers only to the jade of Khotan, yet the author gives much information respecting the mineral from other localities, and discusses the source of the jade which is found in the pile-dwellings of the Swiss lakes. He also clearly points out the means of distinguishing true jade, or nephrite, from the closely-allied minerals known as jadeite and saussurite.

Correspondence.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—In returning to you my thanks for having so kindly placed before the public in the pages of the REVIEW my memoir upon the subject of "The Utilisation of Tidal Force," I now beg to call attention to the typographical inaccuracies, and the following emendations of the statements already published. In paragraph 1, I wish "basis" to be read as "ratio;" in paragraph 2, for "friction" as "incline," for "agency which men" as "agency which even;" in paragraph 6, for "relief of the expended volume of water" as "each expended volume of water," for "efflux of the tide" as "reflux, &c.," for "each staff to full and half ebb" as "each half to full and half ebb;" in paragraph 11, for "in the discharge of culverts" as "in the discharge culverts."—I am, Sir, yours obediently,

JOHNSTONE NAPIER.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—The article on my patent Breakwater Steamer in the last number of the REVIEW was rather too brief, I hope you will allow me to supplement it by mentioning what I deem an important modification covered by my patent, viz., to have the tube or tubes for the screw or screws confined to the vicinity of the stern instead of extending from stem to stern; thus, if it be thought inexpedient to have the tube or tubes extending the whole length of the vessel, one tube (from the stern) might have a branch opening to each side; or, better still, two tubes might extend a certain length along each side, either within the side of the vessel or without, having a screw or propeller within each.

It seems to me that flat-bottomed boats, on the breakwater principle, might be of great use in landing passengers through the surf at Madras or elsewhere, since it matters not when or whence the waves may come, they find a smooth slope on which to expend their force harmlessly.

Such vessels might, perhaps, be useful as life-boats.—I am, your obedient servant,

W. S. CARMICHAEL, M.D.

3, Annandale-street, Edinburgh,
December 11th, 1873.

The Council of the Geological Society have awarded the Wollaston Medal to Prof. Heer, of Zurich, and the balance of the Wollaston Donation Fund to M. H. Nyst, of Brussels. The Murchison Medal was awarded to Dr. Bigsby, and the balance of the Murchison Fund is to be divided between Mr. Alfred Bell and Mr Ralph Tate, F.G.S.

The "Journal" of the Scottish Meteorological Society for the quarter ending June, 1873, has just been published. Prof. H. Mohn, of Christiana, contributes a paper "On Certain Effects of Currents on the Temperature of the Sea and Air."

M. Faye, in a reply to M. Tarry, on the question of "the Formation of Terrestrial and Solar Waterspouts," brought before the Académie des Sciences, on the 1st of Dec., some striking facts connected with the formation and the progress of terrestrial waterspouts.

In the "Annales de Chimie et de Physique" for January will be found an interesting paper, by M. Berthélemy, "On the Peculiar Undulations produced on the Surface of Liquids under the Influence of Vibrations." These peculiar ripples have been studied by Mr. Tomlinson and others, but many new and curious facts have been observed by M. Berthélemy.

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Editor's Office: 21, *Cockspur Street, Charing Cross, S.W.*

THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON.

ESTABLISHED 1ST MAY, 1862.

Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES.—SESSION 1873-4.

THURSDAY, February 5th.—On "Construction of Iron War-ships and Fort-faces." By J. BELL, Esq., C.E., F.R.I.B.A.

THURSDAY, February 19th.—On "Suppressing Fires by novel automatic means of indicating the presence thereof in Buildings." By P. A. BLAKE, Esq.

TO MEMBERS OF COUNCIL.

Council meetings to take place at 7 p.m. on same evenings.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

A council meeting was held on December 11th, 1873, Mr. A. J. MURRAY in the chair. This was a *pro forma* meeting preceding the members' meeting of the same evening.

The minutes of the last meeting were read and confirmed as being correctly entered.

The following gentlemen, admitted members of the Institute, were ordered to be placed on the list of members:—Messrs. J. Beale, F. H. Williams, W. H. Silcock, J. McSkinning, Marsham, Adams, Penrose, M. Fenton, O. C. D. Ross, Captain T. R. D. Bingham, H. W. Pendred, C.E., J. Fielding, J. Ellis.

At the third members' meeting, held at 4, St. Martin's-place, on Thursday, December 11th—Mr. A. J. Murray, Member of the Council, in the chair—Mr. W. GADD, C.E., of Manchester, read a paper on "Automatic Couplings for Railway Carriages," which is given in another column.

After the paper had been read, the following discussion ensued:—

Mr. MURRAY (Chairman), in inviting discussion, said he thought the invention was one of great merit, but as he saw many gentlemen present who were well qualified to give an opinion on the subject, he would call upon them to do so.

[CONTINUED ON PAGE 22.]

Monthly Notices.

The "Creeping" of Railway Rails.—This peculiar movement, which has been ascribed to the motion of the earth, is, it seems, found more apparent in the western rail if such lines run north and south.

Sound and Music, &c.—Under this title Messrs. Macmillan and Co. have recently published a work by Sedley Taylor, M.A., which investigates the value of mathematical theories of music, and enforces what everyone who knows anything about the matter fully recognises, that such theories must be taken *cum grano salis*, the salt in this case being "musical taste."

Map Drawing by Telegraph.—M. Dupuy de Lome recently made an exposition at the Paris Academy of Sciences, of a new system for sending a plan or topographical sketch by telegraph. Over the plan or map is placed a graduated semicircular plate, or glass graduated; in the centre is a radial arm, also graduated, which carries, in a slide, a piece of mica with a blade point. A fixed eye-piece is adjusted, and, looking through this, the mica point is carried successively over all the points of the plan to be reproduced, and the polar co-ordinates of each noted. The numbers thus obtained are transmitted by telegraph and are laid down by the receiver, who uses a similar arrangement to that referred, and thus obtain a correspondent's map.

A Saw of Diamonds.—"The American Manufacturer and Builder" states that at the Exhibition of the American Institution a saw composed of diamonds is used for cutting stone. The saw is on the reciprocating saw principle, the cutting tools being diamonds set in cutter blocks on a steel blade as a guide.

Passage of Gases through the Membranaceous Tissues of Plants.—According to M. M. A. Barthélemy, the leaves of certain varieties of the Begoniaceæ, which are thin on the living plant, are reduced during winter to the condition of pellicle endued with elasticity. These were employed as colloid membranes, and Graham's experiments were repeated, and compared with the films of caoutchouc by M. Barthélemy. These experiments prove the dialysis of carbonic acid by the living plant through the cuticle of leaves, in manner precisely similar to the endosmose of membranes, or of porous vessels, in the experiments of Dutrochet and Dehérain. The details will be found in the "Comptes Rendus," No. LXXVII.

International Copyright.—The commission charged to prepare a revisal of the treaties relative to literary property and fine arts copyrights between France and England, met at the Foreign Office, in Paris, on the 5th Dec. The members of the Commission are: M. Paul Féval (as representative of the Society of Authors and Dramatic Composers), MM. Müller, Oscar Comettant, Paul Saunière, and Pierre Zaccone (for the Society of "Gens de Lettres"), and Mr. Kennedy and his secretary for the English Government. The French representatives protested strongly against the system of "adaptations," which they considered were, in point of fact, piracies now carried on in England. Mr. Kennedy is stated to have replied, he felt sure the British Government would afford satisfaction for any abuses which could be properly brought home. M. Gavard, who was present for the French Minister, asked M. Oscar Commettant to draw out a note on behalf of the music publishers, which was annexed to the minutes of the meeting. Out of thirty-seven states which have conventions with France, only two, England and Spain, have not declared against the plan of depositing copies of works as guarantees of proprietorship on the part of French authors. The system of registration at Stationers' Hall is regarded as most inconvenient—a permanent menace to authors who fear to see their rights confiscated for the profit of everybody except themselves; and the impossibility of always registering within three months has been recognized by the Commission. It is, therefore, formally decided that the system of registration at Stationers' Hall will be abandoned by Great Britain, and that a more liberal treaty of copyright be entered into—one more consonant with honesty.—*Athenæum.*

Professor Galloway has been appointed Dean of the Royal College of Science in Ireland for the year, and the Education Committee of Council have amalgamated the Professorships of General and Applied Chemistry in the College, and conferred the same upon Mr. Galloway.

Directorship of the New Florence Observatory (declined by Father Secchi), has been accepted by Signor Schiaparelli, for some time past in charge of that at Milan. This astronomer obtained the gold medal of the Royal Astronomical Society of London last year (February, 1872), in recognition of his discoveries. In 1861 he discovered the small planet Hesperia, and three years afterwards was the author of a valuable

mathematical paper on Physical Astronomy. He has made himself especially known for his remarkable discovery of the connexion between comets and meteoric showers. In the case of the November meteors, in particular (or Leonides, as they have been called, from the position of their radiant point in the heavens), he was able to show an identity of orbit with the first comet of 1866.

Johnson, Matthey & Co.—The Emperor of Austria has conferred on this firm the Imperial Order of Francis Joseph, for their valuable contributions to the cause of metallurgical science.

Whitburn's Wood Decoration consists in printing on soft white pine. The process is simple, and might be used with good effect as a cheap mode of decorating furniture.

New Books on Natural History.—Amongst noticeable works just issued from the press, we have to mention "The Illustrated Book of Poultry," by Lewis Wright (Cassell, Potter & Galpin.) "Pheasants for Coverts and Aviaries," by that eminent naturalist, B. Tegetmeir (Cox), and "The Smaller British Birds," by H. G. and H. B. Adams (Bell & Sons).

Prof. Challis on a Theory of the Source of Terrestrial Magnetism is the title of a paper in the last number of the "Philosophical Magazine," explaining his views of the modes of generation of those steady streams of the ether, by the agency of which the principal facts of the proper magnetism of the earth may admit of explanation.

Combustion of Water.—Prof. C. Piazza Smyth, the Astronomer-Royal of Scotland, in a paper read at the Manchester Literary and Philosophical Society, said "that water is a far more powerful exploder than gunpowder if you can get the water to explode at all." After showing that great heat will, under certain conditions, cause water to explode, he leaves the further development of the subject in the hands of men of science.

Mr. Frederick Ransome has lately made public some recent improvements in the manufacture of Artificial Stone; a new and improved variety of which he gives the name of Apsenite.

Duration of Discharge of the Leyden battery, by Herr P. Reiss, is the title of a paper in Poggendorff's "Annalen." The author maintains that the time occupied by the discharge is, in general, not the same as that of the spark.

Prof. Helmholtz, of Berlin, has communicated to the Royal Prussian Academy of Sciences the results of his researches on the polarization of platinum electrodes employed in electrolysis.

Sir J. Lubbock on the Origin and Metamorphoses of Insects is the title of a new work, issued by Macmillan and Co. It is an amplification of the worthy baronet's address delivered as President of the Biological section of the British Association, at Brighton, in 1872.

A few days only before his death, Prof. Agassiz completed a paper "On Evolution and Permanence of Type." This has been printed in the *American Monthly*, and is well deserving attention, the author's views with regard to the evolution hypothesis being well known.

THE INVENTORS' INSTITUTE.

(*Continued from page 21.*)

Mr. MACKEY thought that the mode of engaging and disengaging shown by this invention was a step in the right direction. He was not aware of anything like this coupling, though he had seen an approach to it tried on the London, Chatham, and Dover Railway, but he had never studied its action. Loose couplings, in order to show their efficiency, should be tried at high speeds. He would like to know whether this coupling admitted of foreign carriages being attached to a train? The invention seemed to be very promising.

Mr. ROE said he would like to know whether the invention was applicable where a carriage has spring buffers? also if applicable to a cattle-truck, where you find no springs? and whether in the latter case the blows would be likely to cause the coupling to shoot beyond the mark, and become disengaged. Further, when spring buffers are used, then, he thought, there might be some difficulty in engaging, by reason of the resistance of the springs, but in order to overcome this he considered that the coupling should be made to project, say, three inches before the buffer, and so to engage two carriages you will have a pressure of, say, six inches. He did not see much difficulty in the case of luggage trains, where springs were not used. But it seemed to him that the one objection to the invention would lay in the spring that was used to keep the coupling up to its work. Still, in his opinion, its great advantage was that it was the negative state of those springs that keeps the coupling in order.

After a few incidental observations by other gentlemen present,

Mr. GADD stated that it was quite true that the great advantage lay in the negative action of the springs, as stated by Mr. Roe, and that its construction admitted of quick coupling and uncoupling; further, that the holding power of the coupling, if made of the requisite strength, was very great, and that each carriage is calculated for so as to meet the work that it is necessary to do. The great loss of life occasioned by the present coupling when a carriage leaves the line is in consequence of its dragging the rest of the train with it, which is, by this coupling, obviated, for as soon as the carriage tilts up it disengages, and, therefore, does not drag the other carriages off the line, and it should be kept in mind that the surface of the sliding faces of the coupling is made about seven inches square, so that the jumping of a carriage, which before it leaves the line is never less than two to three inches, would not disengage the coupling.

The CHAIRMAN said that all would agree with him that this was a most ingenious invention, and he would therefore propose a vote of thanks to the reader of the paper.

Mr. GADD stated that he was not the inventor, but the inventor, Mr. Green, was himself present.

Mr. CAMPIN (the Secretary) then suggested that, in accordance with the practice of the Institute, Mr. Green's name be coupled with Mr. Gadd's in the vote of thanks.

The CHAIRMAN moved a vote of thanks to Mr. Gadd, and coupled Mr. Green's name with it. This was put to the meeting, and carried unanimously.

The SECRETARY then announced that the meetings appointed to be held in January next (1874), would take place on Thursday, the 8th, and Thursday, the 22nd; that on the 8th would be a conference of the Council and members on Patent Law Reform; the subject for consideration on the 22nd would be duly found announced in the Journal.

After a vote of thanks to the Chairman, the meeting dissolved.

At the meeting of Council, held on January 8th, 1874, the minutes of the last meeting were read and confirmed as being correctly entered.

A proposition was made for retaining a book-keeper. This was referred to the Secretary to report further thereon.

Mr. CAMPIN (Secretary) represented that communications had been made from certain gentlemen who formed the joint committee of members of the Inventors' Institute and members of working class organisations in regard to laying the case of Patent Law Amendment before Mr. Gladstone (the Prime Minister) by deputation.

It was resolved that the Secretary be authorised to take measures to get Mr. Gladstone to receive such a deputation, and immediately communicate with the Council thereon.

The following gentlemen, admitted members of the Institute, were ordered to be placed on the list of members—viz., Messrs. Alfred Tucker, James Harrison, and W. H. Moore.

At the meeting of Council, held on January 22nd, 1874,

The Secretary reported that he had taken steps to retain a book-keeper in accordance with resolution of last meeting. He also reported that application had been made to the Prime Minister (Mr. Gladstone) to receive a deputation on the Patent Laws, and was now in correspondence with him on the subject.

Mr. Cromwell Varley was elected a member of the Council.

The following gentlemen having been admitted as, were ordered to be placed on the list of, members of the Inventors' Institute—viz., Messrs. F. Faulkner, E. Moriarty, J. Libert, F. Weldon, S. Howard, B. Cockayne, J. Lancaster, H. Walters, G. Webb, J. A. McKee.

Prof. Raymond, President of the American Institute of Mining Engineers, wishes it to be generally known that preparations have been already commenced for holding an International Exhibition at Philadelphia, in 1876. The Institute invites the "Iron and Steel Institute" of this country to visit America at that time, and extends invitation to the scientific societies of Europe generally.

MANCHESTER SOCIETY FOR THE PROMOTION OF SCIENTIFIC INDUSTRY.—It has been announced that this promising institution, recently noticed in our columns, would, at the end of January, or the beginning of February, hold an exhibition in Peel Park, Manchester, of appliances for the saving of fuel. This exhibition is to be divided into eight sections: these embrace the getting of coal, coal-cutting machinery and the like, the combustion of coal in furnaces and the production of steam, domestic fire-places, and all appliances for warming or ventilation.

At the meeting of the French Academy on January 12th, M. Le Verrier announced the completion of his tables of the planet Jupiter, which, he remarked, perfectly represented his motions from the epoch of the Greenwich observations in 1750 to the present time. There would appear therefore to be no other disturbing cause acting upon Jupiter sufficient to produce any effect appreciable by observation, besides those of the known bodies of the solar system. The perturbing effect of the large group of minor planets was found to be quite insensible. By the formation of these tables, M. Le Verrier has earned a new debt of gratitude from astronomers, who already owe to him the possession of Tables which have superseded all others for the computation of the places of Mercury, Venus, the Earth (or Sun) and Mars, in their respective orbits. It will be in the recollection of many that the Royal Astronomical Society of London marked their sense of the value of these by the award of their gold medal in February 1868.

Proceedings of Societies.

ROYAL SOCIETY.

DECEMBER 11TH.—Dr. Hooker, C.B., President in the chair. The following papers were read :—"A Quantitative Investigation of certain Relations between the Gaseous, the Liquid, and the Solid States of Water Substance," by Professor J. Thomson ; "On the Action of Heat on Gravitating Masses," by Mr. W. Crookes ; "On the Male and the Structure of *Thaumops pellucida*," by Mr. R. von Willemoes-Suhm ; and "On the Action of the Ribs in forced Breathing," by Dr. Ransome.

January 8th.—The President in the chair.—Papers were read by Mr. M. Simpson "On the Brom-Iodides ;" by Dr Stenhouse "On Orcins ;" by Prof. Cayley "On the Transformation of Elliptic Functions ;" and by Mr. G. Gore "On Electro Torsion."

January 15th.—The President in the chair.—The following paper was read : "Preliminary Account of an Investigation on the Transmission of Sound by the Atmosphere," by Dr. Tyndall.

GEOLOGICAL SOCIETY.

DECEMBER 17TH.—Professor Ramsay, V.P., in the chair.—Messrs. W. T. Loveday, N. Griffith, F. D. Godman, E. T. Newton, T. W. Hilton, and the Rev. C. R. Gordon, were elected Fellows. The following communications were read : "Observations on some Features in the Physical Geology of the Outer Himalayan Region of the Upper Punjab, India," by Mr. A. B. Wynne ; and "On the Mode of Occurrence of Diamonds in South Africa," by Mr. E. J. Dunn.

MATHEMATICAL SOCIETY.

DECEMBER 11TH.—Professor Cayley, V.P., in the chair. Messrs. H. Lamb, R. R. Webb, and the Rev. M. M'Wilkinson, were elected members, and Messrs. E. J. Lambert and R. F. Scott were proposed for election. Professor Clifford gave an account of his paper "On the Graphic Representation of the Harmonic Components of a Periodic Motion." Professor Cayley spoke on the subject of Steiner's Surface, and exhibited a diagram of it. Lord Rayleigh, Mr. Roberts, and Professor Cayley made short communications to the society.

January 8th.—Dr. Hurst, President in the chair.—Messrs. Lambert and R. F. Scott were elected Members ; and the Revs. Dr. Booth, W. H. Laverty, and Mr. W. J. C. Miller, were proposed for election.—The following communications were made : "On the Transformation of Continued Products into Continued Fractions," by Mr. J. W. L. Glaisher ; "The Foundations of the Differential Calculus and of Dynamics," by Prof. Clifford ; "Method of Treating the Kinematical Question of the most General Displacement of a Solid in Space," by Prof. Crofton ; and "Link Trammels," by Mr. Perigal.—The following were taken as read : "On Hamilton's Characteristic Function for a Narrow Beam of Light," by Prof. J. Clerk-Maxwell ; and "Preliminary Account of Investigations on the Free Motion of a Solid in Elliptic Space," by Prof. Clifford.

ANTHROPOLOGICAL INSTITUTE.

DECEMBER 9TH.—Prof. Busk, President, in the chair.—Mr. I. Abrahams was elected a Member.—The following paper was read : "Ethnological Data from the Annals of the Elder Han," Part I., translated by Mr. A. Wylie, of Shanghai, with an introduction by Mr. H. H. Howorth. The Imperial Chinese annals of the various dynasties, which are as yet almost untouched, are distinguished by the extreme accuracy of their details, and in them is to be found a valuable account of the intercourse of China with its neighbours, reaching back in contemporary annals to at least the second century B.C. The series of Chinese annals begins properly with those of the Han dynasty, which reigned from about 202 B.C. to about 220 A.D. That was the golden prime of Chinese history, when the empire reached its furthest limits, when Buddhism was introduced, and when a great literature flourished. During the dynasty of Chow, the old Imperial unity had been invaded by creation of various feudatories, who became almost independent. It was the aim of the immediate predecessors of the Han dynasty to destroy those feudatories, and to restore the unity of the Empire ; and to effect that purpose, all the ancient books and histories were ordered to be burnt. The annals in the present communication contained an account of the numerous conquests from the date of the Elder Han, and embrace the history and migration of a large portion of the peoples of central and eastern Asia.—Mr. H. H. Howorth communicated the twelfth and concluding paper "On the Westerly Drifting Nomades : The Huns."

ZOOLOGICAL SOCIETY OF LONDON.

November 18th.—Dr. A. Günther, V.P., in the chair.—Mr. Sclater pointed out the characters of two new species of birds obtained in the State of Antioquia, Columbia, and named *Chlorochrysa nitidissima* and *Grallaria ruficeps*. A letter was read from Mr. R. Swinhoe, on the White Stork of China, and stating that he had recently obtained a live Pitta in China, which appeared to be *Pitta nympha* of the Fauna Japonica. Mr. A. H. Garrod pointed out certain peculiarities in the cæcum of the Crab-eating Fox (*Canis cancrivorus*). Mr. J. E. Harting made remarks on a curious variety of the Common Partridge shot in Northumberland. Mr. Sclater made remarks on a pair of horns of the new Bubaline Antelope from the Bogos country, lately named *Alcelaphus tora* by Dr. Gray. Letters and papers were read : from Dr. J. E. Gray, containing a paper by Dr. E. L. Moss, on a singular Virgularian Actinozoon taken at Burrard's Inlet, close to the Northern Mouth of the Fraser River ; from Dr. O. Finch, on a new Passerine Bird which he had received from Mr. T. Kleinsmith, of Levuka, Ovalau, Feejee Islands ; this little bird, which was not only new as a species, but also the type of a new genus, he proposed to call *Lamprolia Victoriæ* : from Mr. W. S. Atkinson, on two new specimens of Butterflies from the Andaman Islands, which were named respectively *Papilio Mayo* and *Euplœa Andamanensis* ; by Dr. Cobbold, being the first series of papers, entitled "Notes on the Entozoa," being observations based on the examination of specimens contributed at intervals by Messrs. C. Darwin, R. Swinhoe, C. W. Devis, and others, by Mr. E. Ward, on a new bird of Paradise, of the genus Epimachus, which he proposed to call *E. Ellioti* ; from Surgeon-Major F. Day, on Indian Fishes, mostly copied from the original manuscripts of the late Dr. Hamilton Buchanan ; by Mr. J. W. Clark, on the Eared Seals of the Auckland Islands, one of which he recognised as *Otaria Hookeri*, thus fixing the locality of this species.

January 6th, 1874.—Dr. A. Günther, F.R.S., Vice-President, in the chair. The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of December, 1873, and called special attention to a female onager, or wild ass, presented to the society by Capt. Henry Lowther Nutt, and a pair of the new Japanese storks (*Ciconia boyciana*), brought home by Mr. R. Swinhoe, and presented to the society by Mr. R. H. Boyce, Chief of H. M. Office of Works at Shanghai. The Secretary also called the attention of the meeting to a pair of the spotted wild cat (*Felis torquata* of Jerdon), which had been presented to the society by Capt. J. J. Bradshaw, who had taken them as kittens in the Scinde Valley, Cashmere. Dr. A. Leith Adams exhibited and made remarks on the horns of a feral race of *Capra hircus*, from the Old Head of Kinsale. The horns were very remarkable for their large size and very close resemblance to those of *Capra ægagrus*. Mr. P. L. Sclater, F.R.S., read a synopsis on the species of the genus *Synallaxis*, of the family *Dendrocolaptidæ*. The specimens of this difficult group in nearly all the principal collections of Europe and America had been examined, and the existence of 58 species ascertained, besides three of which the types were not accessible, and which were considered to be doubtful. Mr. George Busk, F.R.S., read a paper on a New British Polyzoon, proposed to be called *Hypparia egertoni*, after Sir Philip Egerton, who had discovered it growing upon the carapace of a specimen of *Gonoplax angulatus*, dredged up at Berehaven in the course of last summer. Mr Alfred Sanders, F.Z.S., read a series of notes on the myology of *Phrynosoma coronatum*. A communication was read from Dr. J. E. Gray, F.R.S., containing a description of the Steppe-cat of Bokhara, which he proposed to designate *Chaus caudatus*. Sir Victor Brooke, F.R.S., read a paper on Sclater's Muntjac and other species of the genus *Cervulus*. In pointing out the distinctions which characterise the three existing species, *Cervulus muntjac*, *C. sclateri* and *C. reevesii*, the author showed *C. sclateri*, the species of most northern range, to be intermediate in specific characters and size between the two others. Sir Victor pointed out an advance in the specialisation of the tarsus of *Cervulus* not hitherto observed. In this genus the navicular, cuboid and second and third cuneiform bones were anchylosed together and formed one single bone, the first cuneiform being represented by a very small and separate bone. A second paper by Sir Victor Brooke contained the description of a new species of deer from Persia, a pair of horns of which he had received from Major Jones, H.B.M. Consul at Tabreez in Persia, and which he proposed to call *Cervus mesopotamicus*. Major H. H. Godwin Austin read a paper on some birds, obtained by him in 1872-73 along the main water shed of the Brahmaputra and Irrawaddy Rivers. Of these ten were considered as new to science, viz. :—*Sitta Nagensis*, *Garrulax galbanus*, *G. albosuperciliaris*, *Trochalopteron cineraceum*, *T. virgatum*, *Actinodura waldeni*, *Layardia rubiginosa*, *Prinia rufula*, *Cisticola munipurensis*, *Munia subundulata*. Mr. Garrod made some remarks upon the morbid symptoms presented by the Indian rhinoceros that had lately died in the Society's gardens, and upon certain points in its anatomy. Mr. Edwyn C. Reed communicated a paper on the Chilian species of the Coleopterous families *Cicindelidæ* and *Carabidæ*.

January 20th, 1874.—Professor Newton, F.R.S., Vice-President, in the chair.—Mr. Sclater exhibited two skulls of Baird's tapir (*Tapirus bairdi*) received from Mr. Constantine Rickards, of Oaxaca, Mexico. The receipt of these specimens proved that this tapir extended from Panama through Central America into Southern Mexico and was probably the only species of this genus to be met with in America, North of the Panamanic Isthmus. Mr. Sclater also exhibited and made remarks on skulls of *Ovis arkar*, from the Altai Mountains, and the stuffed skin of a specimen of the wild ibex of Crete. Mr. E. Ward exhibited two feet of a fawn, the mother of which had had double hind feet, and had for several years brought forth fawns having the same malformation. A communication was read from Dr. O. Finsch containing the description of an apparently new species of parrot from Western Peru, which was proposed to be called *Psittacula andicola*. A second paper by Dr. Finsch contained the description of a new species of fruit pigeon from the Pacific

Island of Rapa or Opara. This unique specimen had been sent to the author by Mr. F. W. Hutton, of Otago, New Zealand, after whom it was proposed to name the bird *Ptilonopus huttoni*. A note was read by Major O. B. C. St. John, F Z.S., on the locality of the Beatrix antelope (*Oryx beatrix*), which was believed to be the South of Muscat. Mr. Edward R. Alston read the description of a new bat of the genus *Pteropus*, which had been sent to him from Samoa for identification by the Rev S. J. Whitmee. Mr. Alston proposed to call this species *Pteropus Whitmeei*. A communication was read from Mr. A. G. Butler, containing a list of the species of *Fulgora*, with descriptions of three new species in the collection of the British Museum A communication was read from Mr. Herbert Druce, F.Z S., containing an account of the Lepidopterous insects collected by Mr E Layard, at Chentaboon and Mahconohaisee, Siam, with descriptions of new species.

MICROSCOPICAL SOCIETY.

JANUARY 3RD.—C. Brooke, Esq, President, in the chair - Dr. A. Carpenter was elected a Fellow. -The names of gentlemen proposed for election as Officers and Council were read by the Secretary, and Mr. Jones and Mr. Suffolk were elected auditors.—A communication from Lord Osborne, offering to supply rotifers to Fellows who would apply to him, was read to the meeting.—Mr. C. Stewart gave a *résumé* of a paper contributed by Dr. H. D. Schmidt, of New Orleans, "On the Origin and Development of Red-Blood Corpuscles in the Human Embryo," and illustrated his remarks by black-board diagrams, enlarged from a number of drawings which accompanied the paper.—A discussion followed, in which Dr. Lawson, Dr Matthews, Mr. Stewart, and the President took part.—A paper was read by Mr. A. Sanders, "On the Zoosperms of Crustacea and other Invertebrata."—Specimens of a simple method of preparing drawings of microscopic objects for class illustration were introduced to the notice of the meeting; and Mr. Richards exhibited a new arrangement for a tank microscope, for the examination of objects under water to a depth of eight inches.

VICTORIA (PHILOSOPHICAL) INSTITUTE

THE first meeting of the ninth session took place recently, at the Society's House, 8, Adelphi-terrace. The election of forty-two new members was announced, making an increase to the strength of the Institute of upwards of one hundred members during the year.

Amongst those elected were Professor Hodge, LL.D. (U.S.), Canons J. B. M'Caul and Woodrooffe, the Rev. F. Garden (subdean), Dr. J. A. Hessey, and Rev. A. W. W. Steel (Caius); also, Messrs. F. A Bevan, J. Bridge, E. Gosse, E. Howard, J. W. Lea, R. Trotter, W. M. Walters, and a large number of other laymen.

A paper on Buddhism was read by Bishop P. C. Claughton, at a rather crowded meeting of the Victoria (Philosophical) Institute, recently held at the House of the Society of Arts. The proceedings of the evening were commenced by announcing the election of several new members, after which letters of apology were read from the Bishops of St. David's, Peterborough, Hereford, and others, and Professors E. H. Palmer, Bright, Westcott, Swainson, Max Muller (from whom a communication was afterwards read), and others. Bishop Claughton commenced by considering Buddhism—which was rather a system of philosophy than a religion—as it existed in Ceylon in the present day; after which he proceeded to examine the theory of Buddhism as taught by its priests, and showed that, whilst it inculcated a system of morality, that system had no sufficient principle or motive; and although, as a system, it was not comparable to the Christian religion, yet all who had studied its recognised books would grant that it was the best outside that religion. He concluded by showing that the natural results of its teaching was to foster superstition. The discussion was commenced by the reading a letter from Professor Max-Muller, in which he stated that "judging Buddhism from its sacred books, he was not led to differ much from the Bishop in his estimate of it."

SOCIETY OF BIBLICAL ARCHÆOLOGY.

TUESDAY, Jan. 6TH.—Dr. Birch, K.R., F S A., F.R.S.L., President in the chair.—Sixteen members were elected.

The following papers were then read :—

1. The Sallier Papyrus containing the Wars of Rameses Meriamun with the Khita. Translated with annotations by Professor Lushington. This well known text was supplemented by a fragment from the Raifet collection, it contains perhaps the most vivid picture of a pre-Homeric battle extant; the king himself, the chief actor, frequently speaking in the first person The two finest passages, the prayer of Rameses to his father Amun, and the defeat of the Hittites, possessing peculiar beauty, in addition to the interest attaching itself to a people who about 1200 B.C. were formidable enemies to the Egyptians themselves. The value of the translation was enhanced by philological notes.

2. On some Illustrations of the Book of Daniel from the Assyrian Inscriptions. By H. Fox Talbot, F R.S. In this paper the learned Assyriologist produced corroborative evidence of the extreme forms of punishment by a fiery furnace and the lion's den, as related by Daniel, from the annals of Assurbanipal, who states that having conquered his brother Saulmugina he executed him by throwing him into a burning fiery furnace, together with many of his adherents, about the seventh century B.C.

CHEMICAL SOCIETY.

JANUARY 15TH.—Professor Odling, President, in the chair. Mr. W. C. Roberts handed in a table, supplementary to his paper read at the last meeting, and containing complete analyses of all the Standard Trial Plates still extant, dating from A.D. 1477, namely, seventeen gold plates and fourteen silver ones.—The following papers were read: "On the Action of Trichloracetyl Chloride on Amines. I. Action on Aniline," by Dr. D Tommasi and Mr. R. Meldola This reaction gives rise to a substance called *phenyl-triacetamide*, which crystallizes in lustrous plates. It is acted on by nitric acid with production of *dinitrophenyl-triacetamide*, crystallising in yellow needles.—"Note on the Action of Sodic Ethylate on Ethylic Oxalate and other Ethereal Salts," by Dr. H. E. Armstrong.—"On the Products of Decomposition of Castor Oil, I. Sebacic Acid," by Mr. E. Neison, giving an account of the preparation and properties of pure sebacic acid, and of many of its salts.

METEOROLOGICAL SOCIETY.

JANUARY 22ND.—Annual Meeting.—Dr. R. J. Mann, President, in the chair.—The Report of the Council dealt principally with the various alterations made at the Society's library at 30, Great George-street, and with the efforts which the Council have been making to extend the operations of the Society, and rest them upon a broader basis than heretofore. The Council took advantage of the presence of their Foreign Secretary, Mr. Scott, as one of the delegates from this country at the Meteorological Congress at Vienna, to request him to represent the Society. The Congress was duly held from the 1st to the 16th September, when Mr. Scott presented a paper on the replies received in answer to a series of questions which the Council issued to the Fellows on several points in connection with the hours of observation, instruments, &c., and which has been printed in the Report of the Congress.—The President then delivered his address.—The following gentlemen were elected officers and council for the ensuing year: President, R. J. Mann; Vice-Presidents, C. Brooke, G. Dines, H. S. Eaton, Lieut.-col. A. Strange; Treasurer, H. Perigal; Trustees, Sir A. Brady, S. W. Silver; Secretaries, G. J. Symons and J. W. Tripe; Foreign Secretary, R. H. Scott; Council, P. Bicknell, A. Brewin, C. O. F. Cator, R Field, F. Gaster, J. K. Laughton, R. J. Lecky, W. C. Nash, Rev. S. J. Perry, Capt. H. Toynbee, C. V. Walker, and E. O. W. Whitehouse.

THE INSTITUTION OF CIVIL ENGINEERS.

AT the meeting of this society on Tuesday, the 2nd of December, Mr. Hawksley, President, in the chair, forty-nine candidates were balloted for and declared to be duly elected, including four members—viz., Mr. Henry Thomas Geoghegan, Ex. Eng., P. W. D., India; Mr. Perceval Moses Parsons, Blackheath; Mr. Cyril James Shaw, Chief Engineer, Carwar State Railway Surveys; and Mr. Benjamin Walker, Leeds. Forty five gentlemen were elected associates—viz., Mr. Thomas Airey, Dantzig; Mr. Edward Robert Austin, Strand; Mr. Edmund Scott Barber, Irrigation Office, Colombo, Mr. Hilary Bauerman, Brixton; Mr. Nathaniel St. Bernard Beardmore, Stud. Inst. C.E., Westminster; Mr. William Atkinson Bell, Assistant Engineer, P.W.D., India; Mr. John Brown, Assistant Engineer, Cape Government Railways; Mr. Robert Burton Buckley, Assistant Engineer, P.W.D., India; Mr. Gabriel Gordon Cleather, Kensington Gardens Square; Mr. William Ovenden Collard, Canterbury; Mr. George Cæsar Cooke, Ex. Eng., P.W D., India; Mr. William Milner Crowe, Westminster; Mr. Cyril West Darley, Resident Engineer of the Newcastle Harbour Works, N.S.W.; Mr. Charles Elwin, Stud. Inst. C.E., Pimlico; Mr. James John Alexander Flower, Cape Town, Mr. James Fraser, Inverness; Mr. Walter Faithfull Garland, Stud. Inst. C E., Venezuela; Mr. John Cameron Graham, Greenwich; Major Irwin Montgomery Greig, R.E., Ex. Eng., P.W.D., India; Mr. Henry Woolcroft Hammond, Southampton Buildings; the Hon. Arthur Wyndham Holmes à Court, Surveyor of Public Works to the Government of Antigua; Mr. Osbert Henry Howarth, Stud. Inst. C.E., Westminster; Mr. Arthur John Hughes, Assistant Chief Engineer and Assistant Secretary to the Government of Bengal in the Public Works Department: Mr. Samuel Hunter, Engineer and Manager of the Rochdale Corporation Gas Works; Mr. Charles Henry Grey Jenkinson, Stud. Inst. C.E., Assistant Engineer P.W.D., India; Thomas Lewis Johnson, Borough Surveyor, Barnsley; Mr. Edward Henry Keating, City Engineer, Halifax, N.S.; Mr. William Hubert Kinch, Stud. Inst. C.E., Darlington; Mr. Frank Howard Landon, Stud. Inst. C.E., Assistant Engineer, P.W.D., India; Mr. Charles Lean, jun., Westminster; Mr. Albert Lewis Newdigate, M.A., Harbour Improvement Works, Dover; Mr. William John Adamson Parker, Sheffield; Mr. Manual Hipolito Pena, Engineer to the State of Cundinamarca, United States of Colombia; Mr. Alphonso Raymond, Stud. Inst. C.E., G. W. Ry., Oxford; Mr. Henry Strutt Collette Ree, Beverwijk, Holland; Mr. Charles Remfry, Linares, Spain; Mr. John Kirby Rodwell, Stud. Inst. C.E., Las Minas, Spain; Mr. Aloys Sprenger, Ex. Eng., P.W.D., India; Mr. John Sears Storey, Resident Engineer on the Settle and Carlisle Railway; Mr. Frederick Toplis, Stud. Inst. C.E., Doncaster; Mr. Ralph Hart Tweddell, Westminster; Mr. Nowrojee Nusserwanjee Wadia, Bombay; Mr.

David Wallace, Assistant Engineer, P.W.D., India; and Major David Ward, R.E., Ex. Eng., P.W.D., India.

The Council reported that, acting under the powers of the Bye-Laws, they had recently transferred Messrs. Henry Brady and James Samuel Cooke from the class of Associate to that of member; and had admitted the following candidates as Students of the Institution: Messrs. George Procter Carless, Adolphus James Chancellor, Gerard Cowper, George Lacy Good, Willoughby Rochester Hughes, Alfred William Lawford, Herbert Neal, Robert Charles Frederick Ogilvie, Edward Hermann Pargiter, Edward Robins, and John William Randell, and Sir Thomas Raikes Thompson, Bart.

The newly-elected President, Mr. Thomas Elliot Harrison, delivered an inaugural address on Tuesday evening, the 13th of January, 1874, on taking the chair for the first time since his election. After giving an account of the progress made in various branches of engineering of late years, he spoke at considerable length on the subject of railways and their management, a subject with which he is eminently familiar, being the Engineer-in-chief of the North Eastern Railway, and having been for many years connected with the working as well as the making of railways. Mr. Harrison characterised as ungenerous and unjust the custom of newspaper writers to assert that railway directors and railway managers and officials had no feeling, and that they looked to a saving of expenditure in preference to seeking provisions for the public safety. He believed the public had no idea of the anxieties which attached to those connected with railway management. He had seen directors completely overcome on receiving the report of a railway accident; and, from a few years' experience as a railway manager, nothing would have induced him to continue in office. Those gentlemen ought to receive the greatest sympathy, for he could name men whose early deaths or permanent ill-health might be traced to the laborious work they had had to undergo in the service of the public, and to the constant anxieties incident on their duties. So far from economy governing the actions of directors, he could state from personal experience that when it was clearly shown to them, by their responsible officers, that any improvement would tend to promote the public safety, they did not hesitate to adopt it. Mr. Harrison directed attention to the popular delusion that the various recommendations of the officers of the Board of Trade, such as the block system, interlocking of points, &c., were the inventions of those officers, the fact being that not one of those systems, or any new idea in connection with the working of railways, had ever been suggested by them. He had given a great deal of attention and anxious thought for many years to the subject of accidents, and attached much importance to the item of human fallibility. Accidents frequently occurred in the hands of the most experienced men in a moment of forgetfulness, which no mechanical contrivances could obviate. The very introduction of precautionary measures, such as the block system, would on this score increase the danger, by lessening the sense of responsibility of railway servants, who would not keep so strict a look-out as on an unprotected line. Mr. Harrison finally referred to the great increase in the cost of railway works—30 or 40 per cent. more than a few years ago arising from the state of the labour market. On the general question of the policy of railway companies towards the public he advocated great liberality, especially in giving increased facilities and accommodation, in the reduction of fares in populous districts, and in rendering every encouragement to parties able and willing to develop the industry of the country.

At the same meeting of this Society, Tuesday, Jan. 13th, twenty-one candidates were balloted for, and declared to be duly elected, viz.: Mr. William Smith, Resident Engineer, in charge of the Holyhead Division of the London and North Western Railway, as a Member; and Messrs. Arthur Turnour Atchison, M.A., Stud. Inst. C.E., Assistant Engineer Alexandra Dock Works, Newport, Mon.; Arthur Lloyd Cochrane Bamber, Stud. Inst. C.E., Metropolitan Board of Works; George Horatio Townsend Beamish, Stud. Inst. C.E., Cork; Walter Chapman Burder, Stud. Inst. C.E., Bishop's Stortford; Francis Coffee, Resident Engineer, Kilrush and Kilkee Railway; William Gordon Lynch Cotton, Assistant Secretary Buildings and Roads branch, P.W.D., India; Charles Edward Cowper, Stud. Inst. C.E., Westminster; Jacob Forrest, Managing Director of the Oak Pits Colliery Co., Mold; William Gill, late Poti-Tiflis Railway; John Ellard Gore, Assistant Engineer, P.W.D., India; Richard Fuge Grantham, Westminster; John Alfred Griffiths, Stud. Inst. C.E., Queensland; Richard Lionel Jones, B.A., Engineering Staff of the London, Chatham, and Dover Railway Co.; Robert Nuttall, Westminster; William Lancaster Owen, Chief Engineer to the Monmouthshire Railway and Canal Company; George James Perram, Stud. Inst. C.E., Assistant Engineer P.W.D., India; George Pothecary, Assistant Secretary to the Government of Bengal in P.W.D. of India; John Somerville, Engineer Dublin Gas Company; and Allen Anderson Whitehorn Kingston, Jamaica.

It was reported that the Council, acting under the provisions of the By-laws, had recently transferred Messrs. Frederick Collier Christy, George Frederick Deacon, John Lawton Haddan, George Albert Hutchins, Alexander Leslie, James Mansergh, Henry Prince, and William Vawdrey, from the class of Associates to that of Members; and had admitted the following candidates as Students of the Institution, viz.: Messrs. John George Blackett, Clarence Arthur Cramer, George James Atchison Danford, Henry Evan Griffith Evans, John Coleman Fergusson, Charles MacIntyre Forbes, Thomas Percy Gunyon, John James Hatton, Arthur Cameron Hurtzig, John Pollard, Oswald Milton Prouse, Percy Thursby, Charles Henry Billinhurst Whitworth, and John Henry Williams.

January 20th.—T. E. Harrison, Esq., President, in the chair.—The paper read was "On the Mechanical Production of Cold," by Mr. A. C. Kirk.

ANTIQUARIAN SOCIETY.

JANUARY 15TH.—C. S. Perceval, Esq., LL.D., V.P., in the chair. Mr. M. H. Bloxham, exhibited a Charter granted by King John, A.D. 1200, to the nuns of Steynfield, Lincolnshire; a horn cup found in the well-plate of Lapworth Church, Warwickshire; and a drawing of a glass bottle found under the floor of the nave of the same church; and two leaden tokens found in the playground of Rugby School. Dr. C. Bruce communicated an account of discoveries recently made near the Roman Wall. During the construction of a new bridge over the Tyne, at Newcastle, the workmen came upon what Dr. Bruce believed to be the substructures of three bridges previously built over the Tyne—viz., (1) Hadrian's bridge, (2) a bridge built in the twelfth century, and (3) a bridge built in the eighteenth century. Of the two former bridges, Dr. Bruce exhibited portions of the timbers so found, as well as plans showing the positions in which they were found. Dr. Bruce also exhibited drawings and photographs of various inscriptions and bas-reliefs which had recently been acquired through the zeal of Mr. Clayton.

Dr. Max Schultze, the anatomist, died at Bonn recently.

APPLICATIONS FOR LETTERS PATENT.

(Continued from page 14.)

On October 28th,—3492 to 3505.—W. Pearson. Production or manufacture of coke.—R. Forman. Detergent powder for the cleaning or washing of paint work, varnished work, French polished work of every description, also oil paintings, without the use of either soap or any alkali.—J. J. Martin. Apparatus used in hanging, cooling, and cutting up pigs.—F. F. Warren. Mode and means or apparatus for condensing or reliquifying the vapours of ether or other volatile liquid employed to produce cold refrigerating machines.—J. Imray. Apparatus for coupling and uncoupling railway carriages (com.)—H. Walters and I. Ross. Machine or apparatus for "pickling" plates in the manufacture of tin-plates and other manufactures in metals.—L. Beesley, W. Beesley, and J. Beesley. Machinery for punching and shearing metals and cropping angle iron. H. Lomax, G. F. Bradbury, T. Chadwick, and T. Singleton. Sewing machines.—W. H. Wilkinson. Nails and spikes (com.)—W. Walker, J. Walker, and S. Walker. Direct-acting steam engines for pumping and other purposes.—R. Owen. Obtaining a black pigment for paint by the utilization of a chemical by-product or refuse, and for the machinery or apparatus connected therewith.—E. Sachse. Construction of harmoniums or similar musical instruments with loose reeds, whereby new sounds or tones are produced.—S. T. Pomeroy. Finger-guard and rest for pens or pen-holders. —H. Y. D. Scott. Kilns for burning lime, bricks, tiles, and other articles, and for the calcination of minerals.

On October 29th.—3506 to 3520.—C. T. Owen. Winding engines and apparatus for raising coal, stone, materials, and other heavy bodies.—D. C. Grant. Signals, having for their object to prevent collisions at sea.—J. Laird, jun., and W. Rutherford. Weaving bags, sacks, and other tubular and double fabrics, and the means employed therefor.—S. Bentley and T. Mullard. Heat generator and coal economiser, adapted for all purposes of domestic or other use where facilities for heating and cooking are required.—P. B. Eassie. Pile drivers.—J. Dearnaley and W. J. Potter. Railway chairs. —A. H. Colles. Apparatus for scoring the game of billiards.—T. W. Sidgreaves. Sewing machines.—J. C. Stevenson. Furnace, and means and apparatus connected therewith, for consuming smoke and economising fuel.—R. B. Boyman. Rotary engines for using steam or other expansive fluids.—W. Plant. Apparatus for clipping or shearing horses and other animals.—J. A. Rhodes. Ornamentation of metals.—H. Hibbert. Lock or fastener for securing the position of window sashes.—I. L. Pulvermacher. Apparatus or appliances connected with generating, conducting, and applying electricity for medical and other purposes.—J. G. Tongue. Production of iron bars for the manufacture of bolts, and in the machinery employed for this purpose (com.)

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On November 6th.—3606 to 3622.—C. Jordan. Permanent way of railways, and the method of transferring rolling stock from main lines to sidings in the vicinity of stations.—M. A. Soul. Self-lighting gas apparatus (com.)—T. Ramsay. Hats or coverings for the head, whereby the same are rendered capable of saving life at sea.—J. W. Ormiston. Manufacture of pig iron specially adapted for conversion into steel.—J. Gurney. Construction of taps or valves.—C. J. Ball. Supports for carrying engines used for boring holes in rocks or other hard substances (com.)—J. C. Elliott. "Roughening" horse-shoes.—I. Seward and S. Phillips. An objective musical staff with moveable notes and rests, either separately or in combination with a musical instrument, by which said staff is converted into a musical sounding staff.—E. Moreau. Sewing machines chiefly designed for embroidering and stitching button-holes.—A. Ray. Process for dyeing in different colours any raw wavered stuff of two or more different textile materials (com.)—F. George. Railway points or switches.—W. G. School. Lever escapement in chanism.—H. D. P. Cunningham. Appliances for working ships' yards.—J. J. F. Stevens. Contact apparatus for electric indicators for railway signals.—J. M. Hetherington, for spinning and doubling cotton and other fibrous materials.—L. Warmington. Articles of wearing apparel for children, combining booterkins, gaiters, and drawers, and gaiters and drawers.—J. W. Melling. Safety and relief valves.

On November 7th.—3623 to 3651.—E. Y. Poole. Square-cornered bonding roll tile.—J. Douglas, jun. Breaking or disintegrating peas, beans, Indian corn, and similar produce, also the machinery or apparatus.—H. Riviere. Machinery for manufacturing small articles in wire.—R. Casson. Puddling furnaces used in the manufacture of iron and steel.—M. Samuel. Construction of furniture, applicable to couches, bedsteads, chairs, ottomans, and other articles of furniture.—F. D. Nuttall. Arrangement of gas box and reversing gear, applicable to Siemens' regenerative gas furnaces.—T. Smith. Apparatus for facilitating the making of skep and other baskets.—J. H. Johnson. Metallic cartridges (com.)—T. F. Lynch. Means for facilitating the folding of papers to contain powders and other matters.—A. C. Fraser. Treating and utilizing sewage.—U. De Lange. Manufacture of soap (com.)—A. V. Newton. Embroidery machines (com.)

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On November 10th.—3653 to 3661.—M. Hopkins. Sowing machines.—J. Young. Muriatic acid.—W. Weldon. Manufacture of paper pulp.—W. Pitcher. Craping hair and other fibrous materials, and the machinery employed therein.—P. Jensen. Machinery for reducing woven woollen and other rags in order to fit them for being reconverted into material for fabrics (com.)—T. Hyatt. Construction of buildings and building materials with reference to securing light and ventilation.—W. A. Comber. Spanners or wrenches.—W. Rainforth, sen., and W. Rainforth, jun. Construction and arrangement of combined manure and seed drills.—H. Jubber. Door fasteners.

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THE

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*** In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur-Street, Charing Cross.

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On November 24th.—3825 to 3837.—V Marlin. Applying the down and plumage of birds of all kinds in the manufacture of spun or woven goods.—W. A. Lyttle. Effecting the consolidation of the dust or small fragments of coal or coke into masses suitable for fuel.—W. R. Head. Ventilation of drains, soil pipes, cesspools, and sewers, and the purification of sewage gas.—W. Moss. Steam governors.—L. R. A. Sicard. Producing vacuum in order to preserve meat, food, and other organic or animal substances.—A Collingridge. Refining mineral and other lubricating oils.—J. Kiwell. Cattle and sheep cribs and racks, pens for poultry, dogs, and other animals, horticultural houses and hot-bed frames, a part of which improvements is also applicable to the construction of hurdles and fences.—E. J. Mackie and C. A. Fears. Manufacturing explosive compounds into grain or granules.—R. Green. Storing and [illegible] sewage.—E. T. Hughes. Bolt-cutting machinery (com.)—A. M. Clark. Festooned edging or trimming (com.)—T. D. Briggs and C. Mason. Tanned hides and skins, and the process of currying leather.—P. E. W. Baudé. Guns and gun carriages.

On November 25th.—3838 to 3848.—S. C. Lister. Preparing and combining waste silk.—S. Simmons Ventilation of hats and similar coverings for the head.—C. D. Abel. Means and apparatus for working brakes on railway trains by fluid pressure (com.)—J. J. Sylvester. Apparatus for guiding in a straight or plain path tracing, cutting, or grinding tools, or work operated on by such tools.—F. Wirth. Apparatus for viewing or contemplating photographs (com.)—F. Wirth Method of introducing burning gas into melting furnaces, and the apparatus employed therefor (com.)—A. McFarlane. Machinery to be used in making chairs, and part applicable in other operations in which contiguous parallel spindles have to rotate.—S H Hodges. Apparatus for shaping the soles of boots and shoes (com.)—W. C. Stiff. Machinery for drilling iron and steel.—J. A. Fber, E Lundquist, and J. Rutherford. Concentrators, being applicable for separating substances of different specific gravities. (Complete specification.)—W. R Lake. Gas engines and apparatus for producing gaseous mixtures to be used in the same (com.)

On November 26th.—3849 to 3870.—J. B. Thompson Smokeless furnaces and stoves.—A. H Robinson. Meters for measuring water or other fluids, parts of which are applicable to steam and hydraulic motive-power engines.—J. C A Henderson and M. Eley. Neck-ties or cravats, parts of which are applicable to other articles of wearing apparel.—A Mackie. Type-composing machinery.—P. C. Macgregor. Treating, scouring, and dyeing woollen and worsted yarns, and apparatus therefor.—D. Tamet Carriage for common roads (com.)—P. Jensen. Middlings purifiers (com.)—C. Williams Mechanism or arrangements for the propulsion of vessels (Complete specification.)—G Goldsmith and J Dilkes. Self acting gates or sluices for preventing the overflow of water from rivers or water-courses.—W. Brown. Manufacture of reps, Turkey satin cloths, borderings for furniture, carriage linings, dress goods, and fringes.—N. W Mitchell. Machine or method for sizing corks, or for separating and distributing the different sizes of corks or other articles requiring to be sorted into different sizes.—E. A. Ramsden and W Dawes. Machinery or apparatus for indicating or registering the number of passengers travelling by public vehicles.—D. Semple. Violins.—M. Gray. Mode of maintaining the insulation of underground telegraphic wires.—M. Gray. Method of insulating and maintaining the insulation of underground telegraphic wires.—A. V. Newton. Manufacture of waterproof boots, shoes, and gaiters (com.)—A. Ford. Manufacture of asphaltes.—J. T. Palmer and R. Dixon. Manufacture of improved fuel from bark, tan, and other substances.—R. Harrington. Umbrellas and parasols.—J. F. Parker and A. Wade. Process and apparatus for the manufacture of coke and illuminating gas, part of which may also be applied to the smelting of iron ores and other ores.—F. A. W. Clarke and B. F. Donnithorpe. Padding or stuffing of upholstery, cushions, and various articles of dress.—I. B. Coldwell. Obtaining motive power.

On November 27th.—3871 to 3887.—C. A. E. Lindemann, M.D. Preservation of every kind of organic tissue by a discovery of a new antiseptic as powerful as innocuous.—R. J. Bedington and T Greaves. Poles for windows, bedsteads, carriage windows, and other upholstering purposes where simultaneous action, either in drawing apart or drawing together the curtains or drapery, is desirable, and which are also applicable to single curtains.—E. Brandon. Constructing and arranging the winding apparatus used at collieries and mines, and for other similar purposes.—E Leigh. Manufacture of artificial fuel.—W. T. E. Bockey. Machinery for excavating and raising materials, such as earth, peat, clay, bricks, and the like.—T. A. Brocklebank. Apparatus for connecting together or "coupling" carriages of railway or other trains.—A. Tooth. Treatment of beer, conferring perfect keeping qualities and prevention of sediment in bottle.—W. T. Smith and E.

(Continued on Page 62.)

Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE

MARCH 1, 1874.

SCIENCE AND THE GOVERNMENT.

Since the abdication of King Cole as ruler of the domains of Science and Art in Albertsland, a dubious kind of unstable rule has there ensued. The paramount authority—the British Government—under whom the whilom potentate exercised his sway, having, by experience of his proceedings, found the relative positions of their ostensibly superior and inferior powers to be in actuality of much the same kind as in the case of the Khedive of Egypt and the Sultan of Turkey—namely, the relation of an inferior who scarcely ever yields obedience to his superior; a state of things quite to the taste of the inferior, but not so pleasing to the superior, Potentate.

Such in reality having been the positions of the abdicated ruler and the British Government, no wonder is it that his abdication was joyfully hailed as a release from an anomalously unpleasant state of things, and the determination made to take such measures as to preclude for the future all chance of recurrence, and, to specially guard against the Government being ever and anon at the behest of a person who ought to be under the control of its authority, compelled to provide funds for carrying out various schemes promoted by such person without previous authorisation. In other words, our Government determined to be no longer bound to undertake the "financing" without the governance of the South Kensington Establishment, which always promised very great things, yet accomplished things not so very great after all.

However, when the Government began to attempt the practical realisation of the contemplated measures it was found that the matter was one of no ordinary difficulty to cope with, for they possessed no knowledge or taste for Arts and Sciences. In fact they soon perceived they had got a white elephant amongst them, and could not tell what to do with it; hence the now existent dubiety as to the system Government ought to adopt as regards South Kensington, and the character of arrangements for effectuating it in the future.

But the late King is not dead; he has only abdicated, and watches with the solicitude of a loving parent over his offspring, ever ready to make his spirit felt in his old domains, if haply opportunity present. Now, this keeps our Government in constant dread of being brought by some Cole Redivivus into the same state of thraldom from which they have just escaped; hence the bright suggestion made to them that safety consisted in shunting the matter altogether was at once accepted with a feeling of relief, and the *modus operandi* transference of the science and art business to the trustees of the British Museum gladly acquiesced to.

This acquiescence, however, was a "reckoning without the host." The abdicated King is not the sort of man quietly to see the labour of his life brought to nothing, and has begun to agitate against the adoption of such a system, in opposition to which he has, it must be owned, a good case to offer, for the Trust Board of the British Museum, as it now exists, is a cumbrous conglomeration of Hereditary Privilege, as regards the Cotton, Harley, Soane, and other families; and of High Officiality, (the Lord Chancellor, the Prime Minister, and so forth), together with a number of members elected by them—a very ill-assorted body, bearing in mind the fact that the non-elected trustees do not attain their positions in consequence of any special aptitude for their work, and, therefore, cannot be expected to be good judges of the sort of persons they ought to associate with them in it, as what by the public will always be considered the active commissioners.

Having so good a case, the abdicated potentate has lost no time in carrying on his counterworking against the proposed scheme with all his old fire and energy, rousing into activity the semi-torpid people of the Adelphi, his great allies and friends throughout his whole career, and with their aid a counter system is now pressed forward, the great feature of which is that, seeing the principal objection to King Cole and his Art and Science plans was the large amount of money he called upon the Government to pay for them that this difficulty is to be removed by the proposed application of the annual surplus of the Patent Office to keeping up the South Kensington Department in an improved form, so as to include a brand new Patent Museum with aids for technical instruction, and so forth.

In other words the money wrung from the poverty of Genius, as our patent taxes have been aptly termed, is to be applied to support the *dilettante* establishment at South Kensington, and a great public work in which the whole nation is deeply interested, namely, the establishment and maintenance of museums of art and science and technical education institutions, must be kept up by money paid as taxes only by inventors and patentees.

We have, as all our readers know, been ever ready to advocate the necessity of every possible aid being given to the promotion of technical education, but we do protest against inventors' money being applied to any than inventors' purposes; and we hold that the first claim upon the Patent Office Surplus is *reduction of the cost of obtaining and maintaining patents*, and the payment of a competent staff of scientific officials to do the work required at the Patent Office for enabling inventors to ensure validity and novelty in their patents.

By all means let us have a *Government department* of science and art, which could be established at the Council Office under the vice-president, or Education Minister, and let him, like the Secretary of State for India, have a board of consultation and guidance, composed not only of representatives of the Royal Society and College of Physicians and Surgeons, but of the Institution of Civil Engineers, *Society of Engineers*, Geological, Geographical, Botanical, Zoological, and other similar societies, and last, but not least, the Inventors' Institute, and although we shall ever then object to the Patent funds paying all the cost of this scheme, we will cheerfully advocate that a handsome contribution be made to it (if any surplus funds remain, which, we firmly believe, will be the case) after the cost of patents has been reduced, and a proper system of granting patents be inaugurated at the Patent Office.

And, in conclusion, we may remark that, although what we have stated refers to the action of the late Government, we see no reason to believe that the views and relations of the new one will be very different in Art, Science, and Patent matters.

Reviews.

OUR IRONCLADS AND MERCHANT SHIPS.

"Admiral Fishbourne on our Ironclads and Merchant Ships." By Rear-Admiral E. Gardner Fishbourne, C.B. London: E. and F. N. Spon, 40, Charing-cross. New York: 446, Broome street. 1874.

Perhaps there is no one better entitled to give an opinion in regard to the construction of ships than the author of this work, for he can speak with all the weight which attaches to the opinions of a man who combines practical experience and scientific knowledge.

That the construction of floating vessels is a matter of the very first importance to this country no one can doubt, and all those who have paid any attention to the progress of marine affairs must acknowledge that fancy and theory have had full swing in presenting us with schemes of improved construction of our sea-craft. The engineer and the ingenious mechanic, and even the journalist, have all in turn come forward to teach the shipwright and the mariner what is the kind of construction they should adopt and favour. Persons whose acquaintance with sea voyaging is limited to an occasional trip down the river in a steamer make propositions of constructive reform with the same confidence as if they had been for years practically engaged in building or handling ships.

Now, Admiral Fishbourne, as we have already intimated, is in a very different position to any of these persons adverted to, and his words are therefore entitled to favourable attention, more especially as their main intent is to shew what are the true principles of "stability" and safety at sea in floating vessels. After remarks on the diverse character and great variety of notions as to the proper construction of ships, commenting especially on the Froude-Reed system, Admiral Fishbourne says:—

All this inconsistency and looseness establishes the unreliableness of the current modes of calculation. Moreover, it is said that in action the ends of the *Inflexible*, which are unprotected by armour, are to be filled with water, and that "directly the water is allowed free access to the ends above the armoured deck, the only reserve of buoyancy is that afforded by the central citadel, but this will be assisted by a belt of cork, 9 or 10 feet in depth, resting on the armoured deck—a plan suggested by Sir Wm. Thomson."

That is, when by this increased immersion the ship is in greater danger of capsizing from being deficient in stability or from being run over by a ram, she is furnished with this cork to save her! The attempt is certainly due to her crew.

This *life*-belt will be efficacious in proportion to its volume, nearness to the water-line, and its horizontal distance from the centre of gravity, together with the smallness of its own specific gravity.

The principle is that which the writer has been for years contending for, and whether it be perceived or not, it is clearly an admission as to the correctness of views herein and long since enunciated by him, and likewise an admission as to the *incorrectness* of the received mode of calculating stabilities.

We are assured that the only hope of safety from numberless disasters, both in the Royal Navy and in the Merchant Service, lies in the adoption of the methods we propose in lieu of the dangerous assumptions we have exposed.

It may be asked, how it is that the system objected to has served for so many centuries? The answer is easy and complete. Owing to the heavy bottoms, and to the heavy weights being placed down in them, while buoyancy was preserved near the load water-line, there was a large margin of error on the *safe* side which was not seriously affected by smaller errors that occurred on the *unsafe* side.

When, in accord with the Froude-Reed destitute of stability system, ships were built upside-down, *i.e.*, with light bottoms and empty spaces in them, and with an accumulation of weight near the load water-line, the margin of error was moved to the *unsafe* side, and though these ships were only saved from capsizing by a reversal of the principle upon which they were designed, their designers will not be persuaded that their fatal disease was want of stability, but still contend that their scheme was good, because these ships possessed, equally with the French *Ocean* class, a nominal stability represented by 2 feet of metacentric height, and the French ships were sailed and did not capsize, forgetting that their metacentric height was 2 feet margin on the safe side, $= 2 = 2$, or 3 feet, while that of the *Vanguard* class was 2 feet — the margin on the unsafe side $=$ nothing or little!

The Admiralty Constructors say truly, that "their calculations do not enable them to determine what is the amount of *stability* which is necessary for a ship to render her *safe* as a sea-going sailing ship. We can merely compare the amount in one ship with another."

We have demonstrated that they cannot do even this latter, that their comparative estimates are radically wrong and dangerous; moreover, that the assumptions upon which their calculations are based, *i.e.*, that a ship revolves round a point in the midship section at the water-line or round the centre of gravity, and that an equilibrating lever, or lever of stability, giving a correct estimate of the stability, is attainable by their system, are untrue and as little worthy of belief as is any other of the most untrue of popular superstitions.

For even were their premises true, they are not worked out with mathematical accuracy. But their premises are not true, inasmuch as they assume an axis and a point in this axis as the origin, a point which has never been determined, and that which they have assumed is not the true one.

Therefore, to continue to design ships on such an hypothesis, and to support colleges and schools to extend and give permanency to such views, is to hinder progress and to guarantee waste of life and treasure.

We have no desire to join in the controversy the Admiral enters into, but we are bound to state that his arguments appear to be thoroughly consonant with common sense, and in conformity with scientific teaching.

One remark, which bears upon the very important question that has been raised by Mr. Plimsoll, we cannot refrain from quoting, for it entirely accords with the plea for caution in dealing with the subject already stated in former pages of this journal.

If the legislation that may be recommended by the Royal Commission appointed to take evidence as to the condition and equipment of the vessels in the Mercantile Navy, shall be based on the supposition that the existing methods of determining the stabilities of ships is correct, very lamentable results will follow, for Parliamentary protection and warranty will be sometimes given to ships in a very dangerous condition.

In this work one point in discussion is so enchained with others, that quotation affords little knowledge of its true scope and effect; we therefore must remain content with the foregoing extracts, and conclude by stating that it investigates the Effect of Unequal Distribution of weight laterally, Defects of Ironclads, and the Stowage of Ships. And in an appendix, the Centre of Pressure, Geometrical Proposition, Determination of the Effects of an Unequal Distribution of Weight on the supposition that the Centre of Gravity is the Axis of Rotation, Rotary Motions and the Principal Axes of Rotation of a Solid body, Principal Axes of Rotation, and Methods of averaging Products.

JORDAN ON THE OCEAN.

"The Ocean: its Tides and Currents, and their Causes." By William Leighton Jordan. London: Longmans, Green, and Co.

This is a very valuable addition to the list of works advancing our cosmical knowledge, being based on the author's "Treatise on the Action of Vis-Inertiæ in the Ocean," and published by him in 1868, in some measure a second edition of "The Elements, or an Investigation of the Forces which determine the position and movements of the Ocean and Atmosphere," published in 1866; the present work being also, to a great extent, a third edition of the same, revised and partly re-written; though in each the subject is treated in a different manner. In "Vis-Inertiæ" the question of the existence or non-existence of any action of that force in the ocean is treated as a question to be solved; whereas in this work the oblate spheroidal form of the earth is accepted as a sufficient demonstration of its action in the ocean and on the surface of the earth, leaving only the amount of that action to be ascertained.

In this work (says the author) I have abandoned the attempt to draw collateral evidence of the action of the forces described as circulating the waters of the ocean from the movements of the barometer; because I have not been able to give the requisite attention to the subject, and the more direct evidence given in this work appears to me sufficient.

In "Vis-Inertiæ" I think I have attributed too much influence to the eastward tendency of the tides in the temperate zones; and I did not notice the northward motion in the southern hemisphere, and southward in the northern, which results from the tides in the temperate zones being normally in advance of that in the equatorial regions.

A great part of "The Elements" has been but a scaffolding for the cosmogony enunciated in this work, and has served its purpose, for the general principles of the work, for the construction of which it has served will now stand without it, notwithstanding its many shortcomings in matters of detail. My inability to give undivided attention to the subject, or, I may say, the inability of my pen, under any circumstances, to do justice to the themes on which it has been employed, may delay, but will not ultimately prevent the triumph of the views which I have here endeavoured to make intelligible to the reader.

As the movements of the ocean and air are so intimately connected that arguments regarding the movements of the one involve, almost necessarily, a consideration of those of the other fluid, it is greatly to be regretted that it has become customary to use terms, in reference to the direction of ocean currents, in exactly the opposite sense to that in which the same terms are used in reference to the winds. This custom is so firmly established that, as the advantages to be gained by altering it are not perhaps sufficient to repay the temporary confusion consequent on a change in the use of terms, the idea of changing the custom cannot perhaps be entertained; though a judicious use of terms has more to do with the progress of any science than is perhaps generally supposed. In speaking of the wind, the terms used denote the direction from which the wind blows; whereas, in speaking of ocean currents, the terms used denote, not the direction from which the current runs, but that towards which it runs. Thus an easterly wind denotes a wind running from east to west, but in the ocean an easterly current denotes a current running from west to east. In order, in some measure, to obviate the confusion which this injudicious use of terms tends to cause, I have invari-

ably used the termination "ward" instead of "ly" in reference to ocean currents, so that as an easterly wind denotes a wind running from the east, an eastward current denotes a current running towards the east. The ordinary use of these terms has been so confused, and their relative meanings so ill-defined, even by the best authorities, that the distinction which I have here made does not interfere with any previous definition of their relative significations.

To show the manner in which "The Elements" has served to evolve the views which are now more directly supported, I may point out that in that work I asserted, simply in consequence of purely abstract reasoning, that a tide must be raised by gravitation on that part of the earth's surface which is in advance in the earth's orbital motion, and that a counter-tide must be raised by vis inertiæ on the opposite side; and also, that a tide must be raised by the sun's gravitation on the side of the earth turned towards the sun, and an equal counter-tide raised on the opposite side by astral gravitation. Both these assertions are absolutely correct, and yet there are only two tides raised (apart, of course, from the lunar tides), instead of the four which the assertions at first sight appear to necessitate. For I have since ascertained, as shown in "Vis-Inertiæ" and in this work, that the force of gravitation which draws the earth onwards in its orbit is that of solar gravitation, and that the force of vis-inertiæ, which acts in the opposite direction to that of the motion of the earth, is the force of astral gravitation, which opposes that of solar gravitation.

The above, and some further prefatory observations which I think it well to offer, are not, however, likely to be clearly appreciated by the reader until after the perusal of the whole work. I think it expedient to say this, lest otherwise what may at first sight appear to be difficulties in the preface might deter some readers from perusing the body of the book, which I am sure no reader of ordinary intelligence will fail to understand.

Since the arguments adduced in the "Treatise on Vis-Inertiæ" have shown that gravitation is an effect of vis-inertiæ, it may here, in reference to the consideration of the forces which determine the configuration of the earth contained in "The Elements" (vol. ii. p. 48), be observed, that gravitation considered as a static force is vis-inertiæ; and that the centrifugal force acting from the axis of rotation is gravitation, and that this latter force of gravitation, as also that which draws the earth onwards in its orbit, is a dynamic force caused by vis-inertiæ in consequence of the action of the dynamic force there termed evanescence. This, however, in no manner interferes with the theory of the forces which determine the configuration of the earth as there described; for the centrifugal force, treated as resulting from the axial rotation of the earth, is gravitation, which is also the force which causes the onward motion of the earth. And these forces of gravitation are equally dynamic actions (and, in fact, inseparably concomitant actions) of vis-inertiæ caused by the action of the force termed evanescence. But, as there stated, the abstract nature of these forces was a question with which we were not then concerned. We were concerned only with the mere matter of fact, that where motion exists there exists some force to cause it; and that where axial rotation exists there exists a force giving the particles revolved in the motion of rotation a centrifugal tendency from the axis of rotation.

This is all with which Newton was really concerned in his demonstrations, as the abstract nature of this centrifugal force was unknown; but in endeavouring to account for it, he went out of his way, and erred in assuming the centrifugal force which opposes the centripetal force of solar gravitation, and holds the planets at their mean distances from the sun, to result from an innate tendency to move uniformly forwards in a straight line; and he doubly erred in assuming this asserted tendency to move uniformly forwards in a straight line to result from an innate force of vis-inertiæ, by virtue of which any body once set in motion tends to continue that motion uniformly forwards in a straight line until other forces from without stop it. For, firstly, I have shown that vis inertiæ opposes motion in everything, and that its own inherent property of vis inertiæ must tend to bring a body to rest, under any circumstances whatever, just as much, and in the same manner, as the action of any force from without. And, secondly, I have shown that, as regards the motion of the planets in their orbits, the centrifugal force which opposes the centripetal force of the bodies which compose the solar system one towards another, and all towards their common centre of gravity, is the force of astral gravitation opposing that of solar gravitation; so that, in their courses, they are borne smoothly along the lines of equilibrium lying between opposing forces of gravitation.

Besides the foregoing, I have shown that the revolving motion of the bodies which compose the solar system round their common centre of gravity would naturally result from the conflicting action of the forces of evanescence and vis-inertiæ, and must consequently continue, until either the motive force termed evanescence is exhausted by the constant resistance of the vis-inertiæ of matter, or until matter is itself exhausted by evanescence. We are not concerned with the question as to whether this latter is an appropriate term: we are simply concerned with the mere matter of fact, that certain forces are in play, causing constant change of form and place; and to the combined action of those forces (to which no name has hitherto been given) I have applied the term evanescence.

The reader will observe that the theory of counter-attraction, or astral gravitation, need not be considered to supplant the Newtonian theory of centripetal and centrifugal forces, but rather to define the nature of the latter force; showing that it is similar to the former: both being gravitation caused by vis-inertiæ, which is just as much the primary cause of the centripetal as of the centrifugal force.

The effects are matters of observation, so that the point at issue is as to how those effects are caused; and I maintain that vis-inertiæ holds the planets in equilibrium, the centripetal force of the sun's gravitation being a part of the action of the planet's vis-inertiæ just as much as the centrifugal force. The error lies in the cause to which the tangental effort is attributed, and I have endeavoured to show that that effort is not caused by the vis-inertiæ of the planet tending to carry it onwards along the tangent, but by astral gravitation (a part of the action of vis-inertiæ) retarding it, and tending to draw it backwards farther and farther from the successive positions to which the revolving force carries it along its orbit.

Vis-inertiæ is the combined action of universal gravitation, which actually does keep the planet on the line of its orbit, opposing any tendency from, as much as towards, the sun.

After careful investigation of this very elaborate treatise, we find nothing we can do which will render better justice to the author or our readers than the reproduction of the above statements, with the declaration of our own approbation of the work.

GENERAL SCIENCE.

"Introduction to Quaternions." By Profs. Kelland and Tait. (Macmillan and Co.)

"Physical Geography." By John Young, M.D. (Collins, Sons and Co.)

"Elementary Inorganic Chemistry; the Non-Metallic Elements." By Raphael Meldola. (Murby.)

"A Manual of Inorganic Chemistry; the Non-Metals." By T. E. Thorpe, Ph. D. (Collins, Sons and Co.)

"Inorganic Chemistry." By Dr. W. B. Kemshead. (Collins, Sons and Co.)

The above works are science school books by authors of more or less eminence in the world of science. We are not in a position to say more about them than that they will be found very useful.

"Animal Locomotion; or, Walking, Swimming, and Flying." By J. Bell Pettigrew, M.D. (H. S. King and Co.)

Anyone who takes an interest in animal physiology will find this work worth perusal. One noteworthy topic is the action of the wing in the flying animal which Dr. Pettigrew claims (adversely to the counter-claims of M. Marey) to have discovered to be "that the wing describes a figure-of-8 track in space when the flying animal is artificially fixed."

"Man and Apes." By St. George Mivart. (Hardwicke.) As the production of a man of eminence, we notice this work, naming the title of which will afford a notion of its contents.

"Outlines of Natural Philosophy." By Bentham Simpson. (Collins, Sons and Co.) These "Outlines" are not very elementary, although stated to be "adapted for upper classes in elementary and middle-class schools;" in fact, it is like many more works now issuing from the press, that proceed upon the false assumption that the mere children who are the pupils at such schools are ready to study all sorts of to them recondite branches of knowledge; whereas they can, with difficulty, be brought up to a respectable standard in the three R's.

PINK AND WEBSTER'S ANALYTICAL CHEMISTRY.

"A Course of Analytical Chemistry (Qualitative and Quantitative)," to which is prefixed a brief treatise upon Modern Chemical Nomenclature and Notation. By WILLIAM W. PINK, Practical Chemist and Metallurgical Analyst, and GEORGE E. WEBSTER, Lecturer on Metallurgy and the Applied Sciences, Nottingham. London: Lockwood and Co., 7, Stationers' Hall court, Ludgate-hill. 1874.

THIS, like most of the treatises in Weale's Series—of which it forms a part—is a very valuable text-book, equally available for the junior and the advanced student, and not without value as a concise book of reference to the professional practitioner.

The authors of this treatise state that they have endeavoured to arrange the Tables of Separation on as simple and efficient a method as possible, in order to prevent the confusion occasioned by many works on this subject.

The reactions of the bases and acids have been selected as those on which the greatest reliance may be placed.

In order that this work may be studied indiscriminately by all who have a knowledge of chemistry (old as well as present students), a brief treatise upon modern chemical nomenclature and notation has been prefixed; the old names of the different compounds have also been placed in parentheses after the new ones. As a sample of the character of the contents of the work, we present our readers with the following extract:—

In going through an analysis of a substance it has to be proved not only that certain elements are present, but that all the other elements are absent, for this reason we cannot adopt the method of indiscriminately adding reagents or tests to the mixture, but must go through a complete course of rules as laid down in this work; that is, it requires not only that the reagents be added in a certain order, but that the substance (sought for) be separated by the

group reagents into families or divisions, and afterwards each group divided and subdivided, until the absence or presence of every element is satisfactorily proved by the resulting phenomena. The separation into groups is effected by reason of the same or similar change being common to two or more elements, these elements would then be said to belong to the same group or division. The student should always, on adding any reagent, pause and consider why such a substance is applied, and what is the chemical or physical change he expects, and what might prevent its appearance. The analyst is, in fact, a judge before whom all the circumstances are laid bare, and on whose judgment depends the decision; he must also remember that hardly any amount of reading or lecture-hearing can produce a practical analyst, as only practice can make perfect, and therefore the student is strongly recommended to make the experiment himself.

The first step is to make a preliminary examination of the substance, and every reaction should be carefully noted down, although the student may not find any direct reference to it in the tables. Mixtures may interfere, and sometimes entirely prevent some of the changes described under the preliminary examination, but it should always precede the systematic. The wet way examination, performed with care, indicates most, if not all, the elements present. Before proceeding to the wet way examination the student should try the solubility of the substance. By studying the table of solubilities much information can be obtained with regard to the elements present; thus, all the salts of sodium are soluble in water; if, therefore, we have nothing soluble in water, sodium is absent; or upon adding water a ppt. is formed, bismuth is indicated. If we require to fuse the substance, we know that (SiO_2), silicic anhydride is present.

The first table is then gone through, each division being laid on one side as finished, until the whole have been completed, after which the divisions A, B, and C are commenced, and the individual elements distinguished; it will at first be desirable that the student should thoroughly study the first table, so that, on a substance being given him, he can at once tell to which group or groups the component elements belong. When he can perform this expeditiously, he may proceed to the separation of the various members of the several groups, and, in fact, undertake the complete course of qualitative analysis.

As it is often necessary to ignite and fuse substances, the following facts must be attended to. Platinum crucibles or capsules are generally employed to ignite substances in, because of their infusibility, pliability, and the resistance they offer generally to the action of many powerful elements when in a nascent condition (that is, just liberated).

There are, however, many operations in which these expensive utensils might be injured, or even totally destroyed, and therefore attention to the following directions (given by Berzelius) should be attended to, namely :—

In the dry way

Never melt in a platinum crucible,

1. Caustic alkalies or alkaline nitrates, consequently,

No saltpetre (NO_5Ko) caustic potash (KHo), or soda ($CONao_2$). Because in such a case, protoxide of platinum would be formed, of course at the expense of the platinum. The protoxide of platinum dissolves in the alkali, and gives it a green colour.

2. No alkaline sulphurets;

Nor sulphates mixed with charcoal powder;

Because alkaline sulphurets act upon platinum with still greater energy than caustic alkalies.

3. No metallic substances:

Nor any mixture which may yield a metallic residue. Gold, silver, and copper may, however, be heated red hot in platinum crucibles without risk, provided the heat be not too near the point at which those metals fuse; but melted lead cannot be poured, even in a cold platinum crucible, without spoiling it.

A drop of lead, tin, or bismuth falling upon a red hot platinum vessel invariably makes a hole in it.

4. No phosphorus or phosphoric acid, mixed with combustible substances; because they would form phosphuret of platinum, in consequence of which the platinum would be melted at that point, or would become shrivelled up.

5. Certain metallic oxides must not be heated to a white heat in platinum vessels;

Because it often happens that at such temperatures they part with their oxygen, in consequence of which their oxygen, whilst escaping, leaves the metal in a nascent condition, and then combines with the platinum as an alloy. The metallic oxides, which have the most tendency to become thus reduced, are the oxides of lead, tin, bismuth, copper, and nickel. If, however, the heat be moderate, they undergo no change.

6. Platinum combines easily with silica and carbon, so that the contact of platinum crucibles with charcoal, at a very high temperature, must be avoided.

In the wet way:

Platinum must never be used with substances capable of disengaging chlorine; wherefore, *Aqua Regia*, even very dilute, must not be put in platinum crucibles;

Nor must any substance containing manganese be dissolved with hydrochloric acid (HCl), because chlorine would be evolved, which will act upon the platinum.

When, for example, the mineral substance to be analysed and calcined with an alkaline carbonate is green or black, it ought to be mixed with hydrochloric acid in a glass vessel, and evaporated until all odours of chlorine has disappeared. In general, all those substances may be boiled or evaporated in platinum crucibles, which do not contain either chlorine or bromine.

In filtering, the great requirement is rapidity, and to effect this, it is best to have the operation performed in an atmosphere of steam; to accomplish this the filtering should be conducted over a vessel of hot water, so that the steam may always be present.

How the details of analysis are set forth the following will show.

REACTIONS OF THE PRINCIPAL ACIDS.

The acids may be classified as follows:—

Group 1, Sub-Division 1, consists of those acids which are precipitated by SH_2, hydrosulphuric acid (sulphuretted hydrogen), from acid solutions, as sulphides.

$AsHo_3$, $AsOHo_3$.—Arsenious and Arsenic Acids.

105 See Reactions Nos. 10 and 11.

Sub-Division, No. 2, precipitated as in Division No. 1, only as the oxide instead of the sulphide.

CrO_2Ho_2.—Chromic Acid.

106. NO_2Ago, argentic nitrate (nitrate of silver), gives a purple-coloured ppt. of CrO_2Ago_2, argentic chromate (chromate of silver).

107. $\left\{ \begin{matrix} C(Me)O, \\ Pbo'' \\ C(Me)O, \end{matrix} \right.$ plumbic acetate (acetate of lead), gives a nice yellow ppt. of CrO_2Pbo'', plumbic chromate (chromate of lead), insoluble in weak acids.

This refers to Quantitative Analysis, whilst the following relates to Qualitative Analysis:—

TESTING THE BALANCE AND WEIGHING.

In Quantitative Analysis it is of the first moment that the balance should be correct to the least amount. A good and practically useful balance should turn very distinctly with a weight of 1 milligramme, or 0·0154 grain. If there is any little variation in the weights required for either scales to weigh a certain quantity, it must be regulated by means of small pieces of tinfoil (not paper, as that will absorb moisture).

The following experiments should be made to test the scales:—

1st. Load both scales with the greatest load they are constructed to carry, the balance then carefully adjusted, and a milligramme added to one scale-pan. This ought to turn the beam to the same extent as if the scales were empty. In most cases, however, it will show somewhat less on the index.

2nd. When both scales are loaded and in equilibrium, the weights are changed, so as to transfer that of the right scale to the left, and *vice versâ*. If the balance is true, and has perfectly equal arms, this will not affect its stability.

3rd. When a balance is disturbed from a state of rest, and made to oscillate, it should always return to its original position and equilibrium.

The balance must stand all these tests, though the least important is a slight variation in the length of the arms, as it does not interfere with the accuracy of the weighing. To keep the edges of the balance free from rust, it is a very good practice to place inside the case a beaker half-filled with sulphuric acid, SO_2Ho_2, or $BaCl_2$, baric chloride. The balance should not be kept in the laboratory.

In weighing, any small variation in the lengths of the arms of the balance will not interfere with the correct results, because, as a rule, we have always one scale-pan for the weights and another for the substance to be weighed; but of course any perceptible error must not be allowed to pass.

The following considerations must be attended to:—

1st. If the substance to be weighed is liable to attract moisture, it should be weighed in a closed vessel, or between two watch-glasses.

2nd. No substance should be weighed whilst hot, as the ascending currents of air caused by the heat of the body under examination will cause the apparent weight to vary every instant.

3rd. In weighing, the weights should be added with care and judgment, not placing a great weight on at first at a venture.

4th. The same plan as is recommended for the qualitative examination of a substance should also be strictly carried out in weighing and all operations connected with the quantitative analysis of a substance—viz., that every operation and step should be carefully noted down in a note-book. The weight of the vessel should be entered, together with the substance weighed, and then the weight of the vessel subtracted, to leave the real weight of the substance.

PIERCE'S DESCRIPTIVE GEOMETRY.

Treatise on "Practical, Solid, or Descriptive Geometry." Embracing Orthographic Projection or Radial Projection. By W. TIMBRELL PIERCE, Architect, late lecturer on Geometrical Drawing at King's College (vice Professor Bradley) and Harrow School. London: Longmans, Green, and Co. 1873.

WE certainly agree with the author of this work in thinking that it will supply a want which has long been felt. It is true, we have innumerable works relating to this branch of study, but the smaller works are mainly too meagre to be styled text books, and in such as treat the subject of solid geometry more fully, we have generally found (as in the case of Professor Bradley's well-known work) that although the illustrations of the various problems are all that can be desired, yet the descriptions of them are usually far too short of what is required to enable pupils, with the ordinary standard of intelligence, to understand or work out the pro-

blems. Therefore, we consider students are indebted to the author of this admirable volume for supplying the want of a good text book for English students; and here we have to remark that the Continental nations of Europe are far before us in this branch of study, for with us in England it is, or has been up to a very recent period, almost a matter of speculation as to what solid geometry really is, whilst in the case of our Continental neighbours in nearly every polytechnical school it is a compulsory branch of study, and this is, we assume, the reason why so many and such excellent works on the subject exist in foreign languages. However, we may confidently expect, now that technical education is becoming a question for immediate settlement, that in the future only the works which will enable the different sciences of practical application to be grasped, will obtain the status of text books, and that these will be of such a character as will compensate for the backwardness which has characterised us up to the present time. Certainly the work under notice is the best of its kind that we have perused, and we cordially recommend it to all interested in the study of solid geometry.

REVIEWS POSTPONED.

"Elements of Chemistry." Fifth edition. By the late W. H. Miller, M.D., LL.D. Revised by Herbert McLeod, F.C.S. Longman and Co.

"Introduction to the Study of Organic Chemistry." By H. E. Armstrong, Ph. D., F.C.S. Longman and Co.

"Polar World." By Dr. Hartwig. Longman and Co.

"The Moon." By James Nasmyth, C.E., and James Carpenter, F.R.A.S. John Murray, Albemarle street.

"Dictionary of Languages." London: Messrs. Hall and Co.

PROGRESS OF TECHNICAL CHEMISTRY.

Amongst proofs of progress in the above department of applied science is the production of the Salts of Potassa. It was long ago foretold by Chemists that the Salts of Potassa would be obtained directly from the mineral kingdom, instead of indirectly through the ashes of terrestrial vegetation, but the prophecy was not fulfilled until 1861, when the commercial production of Potash fertilizers and Chloride of Potassium began at Stassfurt mine. The following year the mine of Leopoldshall, in the Duchy of Anhalt, was opened. The deposit at these places consists of beds of common salt, interstratified with small beds of Carnallite, the hydrated double Chloride of Potassium and of Magnesium, and Kieserite, the hydrated sulphate of Magnesia.

Beside these are found Kainite the hydrated double-sulphate of Potassa and Magnesia, Chloride of magnesium and Sylvine, the chloride of Potassium the latter merely in pockets. Existing distributed throughout the deposit are Boracite and Borate of Magnesia, Chloride of Magnesium, Tachhydrite the hydrated double chloride of Calcium and Magnesium, Anhydrite, the anhydrous sulphate of Lime, and Astrakanite, the hydrated double sulphate of Soda and Magnesia. Carnallite, [illegible] and Tachhydrite contain small quantities of bromides. In 1867 the yield of Potassa Salts in the mines was 3,556,000 centners, number of laboratories 16; in 1872, the yield had risen to 10,234,000 centners, and the numbers of laboratories had increased to 33. Eleven hundred miners and three thousand labourers were employed, and the population, only two thousand seven hundred in 1861, had become twelve thousand.

[illegible] of [illegible] is another of the results of the investigative talent of chemists. As is also the production of Kerosene from Lignite. The first attempt made in Germany to distil off the oleaginous products of Bituminous coal resulted in failure, but more recently a sufficient measure of success has been realised to drive the products of American Petroleum out of the markets of the little State of Saxe, and also out of those of the Kingdom of Saxony and of a portion of Austria. This success is ascribed to the employment of one variety of coal only, the Lignite, and the adaptation of the process to that variety, instead of, as formerly, endeavouring to distil Kerosene from all varieties including Bituminous schist, boghead, &c., in similar apparatus. Indeed it would seem that but few of the Lignites prove profitable, and those from quite restricted localities. The product may be estimated at 100,000 centners of Paraffine, 300,000 centners of Kerosene, and 60,000 centners of second quality Paraffine. The latter is used in the manufacture of lubricating oils and illuminating gas, and is mixed with wax and stearine in candle making. For the same purpose the first quality of Paraffine is used without admixture. It is also employed instead of butter in the beet sugar process and instead of wax in the making of children's dolls, and the impregnation of the wood of matches.

Artificial Madder Dye also evidences the important advances making in technical chemistry. Madder, the colouring matter extracted from the plant of that name, the *Rubia tinctoria* of botanists, is largely produced in Germany and France, and an idea of the total value of the product may perhaps be found in the fact that in the French canton of Vaucluse alone, madder yields annually from 7 to 8 millions of thalers. The colour of the extract is due to Alizarine, which can be obtained from it in red silky crystals, and this substance two German chemists, Graebe and Liebermann, were able to convert into Anthracene, a hydrocarbon derived from gas tar. Before the year 1868, in which they made this discovery had expired they were able to reverse the experiment and convert Anthracene into Alizarine. They thus became the founders of a new industry, the manufacture of artificial Alizarine which, since 1870, has so extended itself that there are from ten to twelve manufactories in Germany, and parties in England and France have begun the business. In 1872 the yield was 22,000 centners of artificial Alizarine paste, valued at four millions of thalers. Gas tar contains about 5 per cent of Anthracene, and is sufficiently abundant to furnish all the Alizarine demanded by the dye works. Although the natural madder red still competes with the artificial, yet the competition cannot last long, and it is probable that in two or three years the cultivation of madder will cease.—From the *Polytechnic (American) Bulletin*.

NOVEL CONSTRUCTION OF MARINE WORKS.

At the Institution of Civil Engineers, on Tuesday, February 10th, 1874, the following paper was read "On the Construction of Harbour and Marine Works with Artificial Blocks of Large Size," by Mr. Bindon Blood Stoney, M.A., M. Inst. C.E. The author described a new method of submarine construction, with blocks of masonry or concrete far exceeding in bulk anything hitherto attempted. The blocks were built in the open air on a quay or wharf, and after two or three months' consolidation, they were lifted by a powerful pair of shear legs, erected on an iron barge or pontoon. When afloat, the blocks were conveyed to their destination in the foundations of a quay wall, breakwater, or similar structure, where each block occupied several feet in length of the permanent work, and reached from the bottom to a little above low-water level. The superstructure was afterwards built on the top of the blocks in the usual manner by tidal work. By this method the expenses of cofferdams, pumping, staging, and similar temporary works were avoided, and economy and rapidity of execution were gained, as well as massiveness of construction, so essential for works exposed to the violence of the sea. There was now being built in this manner an extension, nearly 43 feet in height, of the North Wall Quay in the Port of Dublin. Each of the blocks which composed the lower part of the wall was 27 feet high, 21 feet 4 inches wide at the base, 12 feet long in the direction of the wall, and weighed 350 tons. The foundation for the blocks was excavated and levelled by means of a diving-bell, the chamber of which was 20 feet square, and 6½ feet high. When the men were at work the bell rested on the bottom. A tube or funnel of plate iron, 3 feet in diameter, rose from the centre of the roof of the bell to several feet above high-water level. An air-lock in the top of this funnel afforded a passage up or down, without the bell having to be lifted out of the water. The material excavated was cast into two large trays, suspended by chains from the roof of the bell; when these were filled, the bell was lifted a few feet off the bottom, and the bell-barge was drawn a short distance away from the line of the wall where the stuff was discharged, by tilting the trays, and the bell returned to its work again. The hull of the floating shears was rectangular in cross section, 48 feet wide, and 130 feet long. The aft end formed a tank, into which water was pumped to balance the weight of the block suspended from the shears at the bow of the vessel. The shear legs were rectangular tubular pillars of plate and angle iron, with a cross girder resting on the top; above this girder there were two sets of pulleys, through which were rove the lifting (pitch) chains, formed of one and two flat links alternately. There were eight parts to each chain, or sixteen parts altogether, so that each part had to support, theoretically, one-sixteenth of the suspended block. The inner ends of the chains passed down to the deck, where they were controlled by a pair of powerful crab winches driven by a 14 H.P. steam-engine, which also worked a centrifugal pump for filling or emptying the tank. The slack of the chains, after passing through the crab winches, was led under the deck, and was coiled up in the engine room over fixed pulleys by two donkey engines. When paying out chain the donkey engines were thrown out of gear, and the crab winches on deck hauled up the slack according as it was wanted. Two cast iron girders were built into the bottom of each block, and at the end of each girder there was a rectangular hole. Four vertical tubes were built in the block over these holes in the girders and the suspending bars were lowered from above and turned at right angles, so that their ends which were T shaped, caught beneath the girders. The upper ends of the suspending bars were also T shaped, and were attached in a similar manner to the lower sets of pulleys through which the lifting chains were rove. When a block was set in place, the suspending bars were turned back 90°, and withdrawn for further use. Each block had vertical grooves left in the sides, and when two blocks were in place these grooves formed a tube 3 feet square. A mass of concrete was subsequently thrown into the groove, to act as a key or dowel between block and block; this completely plugged up the joints, which were only about ½-inch open on the face.

The paper also contained a description of an annular block of concrete 19 feet in diameter, weighing 80 tons, which the author constructed for the base of a beacon tower, in the year 1853, and conveyed two miles down the Liffey, where it formed its own coffer-dam in water 3½ feet deep at low spring-tides. The water was pumped out by hand pumps, and the ground has to ex-

cavated, concrete being placed on the top of the ring as it sank, like the brick wells in India, or the shafts of the Thames Tunnel.

The method of making concrete and mortar, adopted by the author, differed in some respects from that in ordinary use. He preferred a rapid mixture of the ballast or sand with cement or lime to the slow triturating process of the mortar pan with edge runners. The concrete mixer, devised by him, driven by a 3 H.P. engine, would turn out from 10 to 12 cubic yards per hour. The mixer was a fixed horizontal or inclined trough, open on the top, with a longitudinal axis, having stout iron blades at short intervals, which, as they revolved simultaneously, plugged the materials and screwed them forward. The water was let on gradually through a rose, and the first few blades incorporated the materials in a dry state before they reached the water.

The author believed the application of the new system of gigantic blocks to the construction of breakwaters, would, in many cases, be cheaper, more rapid and more permanent than the ordinary methods of construction.

FIRE SUPPRESSION.

The following is the principal portion of the paper read at the Inventors' Institute, 19th February, 1874, by Mr. P. A. Blake:—

When you tell a person there are over two thousand fires annually in the metropolis, they say "Dear me!" give a sigh, and then go on to some other subject, as if you had told them there were so many thousand deaths, and it was a very sad thing; but there is no help for it. But the two thousand fires are an evil that may be prevented, and means ought to be taken to do so. To think that every year, in this city alone, some score of persons are burnt to death in their beds, let alone the destruction of several millions worth of property, calls out for something to be done. The money panic in America is attributed by some, and not improbably, to the damage done by fire at Chicago and Boston.

[Mr. Blake added further remarks on the importance of the subject, and the necessity of measures being taken to diminish the number of fires. These, for want of space, we are compelled to dispense with.] He then proceeded: Hitherto nearly all the energy devoted to the subject has been wasted in trying to devise means to put out large conflagrations; now, I maintain, this is an unnecessary and hopeless problem. The practical problem is "to devise an apparatus which must be economical in every respect, to give timely warning of the outbreak of fire.

The following method struck me as simple, reliable, and exceedingly economical:—Quick burning fuses are led from the various parts of the building to a bell alarum, or, what I think far better, two or more maroons, as they are sure to be heard without being necessarily placed near the sleeper's apartments. The fuse is generally passed round the room near the ceiling - it is unobservable, being dyed to match the paper or ceiling; in this room the fuse would be passed round near the ceiling and also beneath the balcony- (here is a short length passed along here; you observe it is scarcely to be seen); it is then carried through the wall and connected with a main fuse. Fuses from other rooms and parts of the building are also connected with this main fuse, which finally leads to the maroons placed in any convenient spot.

The junctions between the branch fuses and the main fuses are such that the fuse burns straight to the maroons, without setting alight to the branch fuses or digressing at all from its path. Here I have one of such junctions possessing the required property of transmitting the fire in one direction only. I apply a light to this end, and the fire passes on and ignites the other. I take another junction and ignite the opposite end, and this time the other end is left unignited. Here is a specimen of a fuse we find best for the purpose; it travels about 100ft. per minute; here is some cased fuse which travels 400ft. or 500ft. per minute.

Supposing this room to be fitted as I describe, which would cost about £5, it is obvious to you a fire could attain but a very small magnitude prior to setting alight to some part of the fuse; a few seconds after the fuse had caught the alarm would be given, and I think I may safely state, from the many like experiments we have made, an eighteenpenny squirt would suffice to subdue the flames.

The following practical test of the efficiency of the alarm we have tried many times:—

Wood was purposely so built up in the coach-house of a stable as to fire the building if we did not succeed in subduing the flames in time, it fairly represented any wooden structure as far as our purpose is concerned, reaching from the ground to the ceiling. The lower part of the stable was fitted up with the fire-alarm I have described; some straw was now put against the wood and set on fire. The result was as I have before explained—the flames could never get beyond a certain magnitude before off went the fuse, and the alarm was speedily given. We have waited from two to five minutes, or more, after hearing the alarm before pumping on the flames, and yet have always succeeded in subduing them with about a pint of water.

I fail to see that these fires we have extinguished in the stables I spoke of are different to the commencement of other conflagrations- the timber was dry, and purposely piled up for burning, and hence I see no reason why nearly all conflagrations should not be put out as easy, if buildings were only provided with a suitable fire alarm. With regard to how soon these fuses ignite, they require a temperature of about 300° Fh., or less than half as that again as boiling water; so in cases were the fire is caused from the overheating of flues, &c., the alarm would be given before there was actual fire, as the fuse is laid wherever danger is apprehended, such as the spot where a flue passes dangerously near some woodwork. Well, then, fires originating from the overheating of surfaces would be detected, or rather the alarm would be given before the place was really on fire. Those that originate from a light thrown down, &c., it is obvious could not be detected before there was any flame, as it originates from a small flame, (and yet I have been told my alarm ought to do this), but as soon as a current of gas heated to 300° comes in contact with the fuse, off it goes—it is not necessary for the flame to touch, as I will show you. I hold a lamp some distance under this fuse, and the heat suffices to ignite it. I have made it ring a bell instead of firing these maroons, as the latter noise would make your ears ring rather unpleasantly. These maroons would do no other damage. I have fired the larger size you see here suspended by a piece of string from my hand. If placed in the midst of paper, they will blow it to pieces without even scorching it.

"A fine idea," says somebody, "to have fuses, maroons, and I know not what placed all over your house. Thank you, I would rather be without your fire-alarm; the house might certainly then go off like a firework—full of fuses and maroons; it stikes me the cure would be worse than the disease."

As this idea is likely to enter the minds of all, more or less, upon the subject being brought before them for the first time, let us see what foundation there is for this supposed danger.

First, with regard to the cure being worse than the disease, considering the disease (viz., part of the building or its contents on fire, and nobody aware of the fact—perhaps all fast asleep) is generally death to the building, and sometimes to its inhabitants. I don't think the cure could very well be worse than that; however, let us see what damage the cure could do. As to the maroons, I have already stated they will not set anything on fire, and as a proof of harmlessness, have fired them only two feet from my own person, and so a broken window pane would be the worst to fear from these. Now as to the fuse. If there were any danger of it setting things alight, we can so hang it as not to give it the chance of doing so; besides it is only the short length between the seat of the fire and the maroons that burns, because of the peculiar junctions; however, practically, it will not set fire to things, as I will show you. I lay a piece of fuse on this paper and ignite it, you see the fuse burns over the paper without setting alight to it. I will lay another piece of fuse on the top of this train of gunpowder, and you see flame runs along the train of powder without firing it. I hope then I have convinced you the danger of this alarm exists only in fancy, not in practice. It is not necessary for me to say much with regard to it saving life from fire, as it is sufficiently obvious, if notice were always given of a fire when it was only a few feet in height, there would be no difficulty found in escaping from the house.

To sum up the arrangement contained in the former part of my paper, I would say, every fire has a beginning; if you discover the fire near this beginning, it is easily extinguished; let then every building be provided with an efficient fire alarm to give warning of this beginning, and to me it appears to follow disastrous fires will be almost a thing of the past.

After the reading of the paper, the chairman (W. Yates, Esq.,) invited discussion, and, in response, Messrs. Fischer, Carttar, and others put several questions to Mr. Blake, which he answered in such a way as to substantiate the statements contained in his paper. Votes of thanks having been accorded to Mr. Blake and the chairman respectively, the meeting ended.

SOLAR TRANSIT INSTRUMENT.

We extract from the "Polytechnic Bulletin," *Philadelphia Journal*, the following:—This instrument was invented thirty-six years ago, by Mr. W. A. Burt, who patented it. Since that time, very few modifications have been found necessary. The original instrument was made by W. J. Young, and since the expiration of the patent, as well as before, this house has, we are told, been the exclusive manufacturer. The instrument consists of an elongated plate, resembling that of a surveyor's compass, on one end of which is a transit telescope, on a single standard, with its accompanying level and vertical arc; on the other a brass vessel filled with lead as a counterbalance. The plate, which is graduated, is clamped to an upper circular plate, which in turn is clamped to the spindle. Observations on the sun at meridian are taken by so setting the instrument, that when the arc is moved to correspond with the sun's declination, a ray shall fall between the two parallel lines. We then have our north and south line and the upper plate is clamped. The needle used for determining the extent of magnetic variation, is contained in a compass-box, which is not circular, but oblong, its ends forming arcs of about 20 degs., and its sides re-entering so that the box resembles two opposite sectors of a circle, of which the point of the needle is the centre. A slow motion appliance brings arc and vernier to 0 deg. when the variation is read off.

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SIR ANTONIO BRADY.

NOTICES.—SESSION 1873-4.

Attendance of Members and their Friends is requested on—

THURSDAY, March 5th.—On "Raising Sunken Ships." By J. VAFEA, Esq.

THURSDAY, March 19th.—Conference of Council and Members on the Patent Laws.

The following are (exclusive of the above) the evenings for members' meetings for the remainder of the present session:—April 2nd, 16th, 30th; May (Annual General) 14th, 28th; June 11th.

TO MEMBERS OF COUNCIL.

Council meetings to take place at 7 p.m. on same evenings, when the attendance of all members of the Council is requested.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

At the meeting of the council (ordinary) held on February 5th, in consequence of the absorbing effects on the public mind of political events now occurring it was considered that no sufficient attendance could be expected to justify the disposal of important business; the only question entered upon was the action to be taken in regard to placing the case of the Patent Laws before the Government, and it was agreed that under present circumstances the matter must remain in abeyance.

The following gentlemen, having been admitted members of, were ordered to be entered on the list of members:—Messrs. F. Vafea, G. W. Hart, W. H. O'Shea, J. Edwards, W. A. White.

At the meeting of the council (ordinary) held on February 19th, 1874, after disposing of some formal business, the following gentlemen, admitted as members of, were ordered to be placed on the list of members:—Hodgkinson, Ardern, Atkinson, Surmon, Lloyd.

At the members' meeting, held at 4, St. Martin's-place, Trafalgar-square, at eight o'clock, p.m., on Thursday, January 22nd, 1874, M. M. Harris, Esq., member of the council, in the chair, Mr. Charles Fox Roe read his paper on "Communication Apparatus for Railway Trains." This was followed by a discussion, and a report is given in another column.

At the members' meeting on February 19th, 1874, held as above, Mr. W. Kates, member of the council, in the chair, Mr. F. A. Blake read his paper on "Suppressing Fires by Novel Automatic Means Indicating the Presence thereof in Buildings." This was followed by discussion, and will be found reported in another column.

Monthly Notices.

Heat disengaged in combination of Oxygen and Azote.—Recently, M. Berthelot brought before the Académie des Sciences a paper, "Sur la Chaleur dégagée dans les Combinaisons de l'Azote avec l'Oxygene." The importance of this inquiry in its relation to the explosive substances of late years introduced, makes it of very great importance.

Professor Asa Gray, of Cambridge University, U.S., and one of the associate editors of the *American Journal of Science and Art*, has been appointed by Congress to fill the chair in the Board of Regents of the Smithsonian Institution, previously occupied by the late Professor Agassiz.

The Mexican Society of Natural History issues in monthly numbers a journal, "La Naturaleza," containing the papers read before the Society. Amongst other matters, we find a notice of a new Mexican mineral. It consists chiefly of bismuth and tellurium, with a little silver, sulphur, and arsenic, and was found in the mine of Coneto, near Durango. There is also a paper "On the Combustible Minerals of Mexico," by the same mineralogist, Don Pedro L. Monroy; and one, "On the Meteoric Irons of Mexico," by Don J. Correjo.

Yield of Gold in Victoria.—The Report of the Secretary for Mines of Victoria, for the quarter ending September 30, 1873, states that 127,086 ounces of gold was obtained from the alluvial deposits, and 161,771 ounces from the quartz mines. During the quarter, according to the Returns from the Commissioner of Trade and Customs, 204,787 ounces were exported from the colony.

Dr. Beke, we hear, left Suez on the 18th Jan., in one of the Viceroy's steamers, for Akaba, the caravan having gone on by land. He confidently expects to be back in England in about a month's time.

Dr. Huggins has been elected by the Académie des Sciences of Paris as Correspondent in the Section of Astronomy, to replace M. Petit; and Mr. Newcomb has been elected to replace M. Valz, in the same section of the Académie.

German geology has recently lost two of her most distinguished professors in Dr. C. F. Naumann, of Leipzig, and Dr. A. E. Von Reuss, of Vienna. Naumann was originally a student, and subsequently a professor, at the Royal Saxon Mining Academy of Freiberg, whence he removed to the University of Leipzig. Equally distinguished as a geologist, a mineralogist, and a crystallographer, he has left behind a rich and varied collection of writings, including some of the best text-books of German science.

Ozone.—Professor Andrews, of Belfast, in a paper read at the Royal Society of Edinburgh, confirms his former experiments on this subject, demonstrating that this mysterious body exists independently in the atmosphere. Facility of change in the nature of ozone was shown by shaking it in a bottle with a little perfectly dried ground glass, when simple oxygen appeared. Dr. Andrews doubts the alleged connexion of atmospheric ozone with the state of public health. As a bleacher, upon trial at Belfast and Greenock, it had proved a failure.

Dr. Alleyne Nicholson, Professor of Natural History in the University of Toronto, has been appointed Professor of Zoology in the Royal College of Science, Dublin.

Electrical Communication in Mines.—At a meeting of the North Staffordshire Institute of Mining Engineers, on the 5th Feb., Mr. T. M. Goddard read a paper "On Communication between the Depths of a Coal-pit and the Surface by Electricity." We hope this subject will receive earnest attention.

Mr. John Pye, the Engraver.—The other day we recorded the death of Mr. Cornelius Varley, one of the oldest painters in Europe, who had exhibited pictures at the Academy not fewer than seventy years ago. We have now to announce the death, on the 6th February, of another aged artist, one of the ablest men in his profession whom this country has produced, a landscape-engraver of the highest class either in this or any former time, a master of the refinements of chiaroscuro, John Pye, who produced the plates after Turner, "The Temple of Jupiter in Egina" and "Ehrenbreitstein," and many other fine examples of the purest style and most poetic rendering of poetry in art. He was born in Birmingham in 1782. He was consequently within a few months of the age to which Mr. Cornelius Varley attained.

The Annual Dinner of the Members of the Institution of Civil Engineers has this year been fixed for Saturday, the 21st of March, at Willis's Rooms, St. James's.

RAILWAY TRAIN COMMUNICATION.

By C. F. Roe, Esq.

The following paper on this subject was read, and discussion occurred, at the meeting of the Inventors' Institute on Jan. 22nd, 1874 :—

In bringing before you for consideration a new mode of railway communication, perhaps it may not be out of place to shortly review the events of the last few years, and the measures taken by the Board of Trade to ensure the necessity for the adoption of some means whereby travellers, in cases of danger, may inform those, in whose care they are, of their position.

In March, 1853, a committee of railway managers, appointed by the Clearing House, recommended the establishment of a communication between guard and driver, but were averse to the same for the use of passengers.

In 1855, the London and North Western Railway Company tried the electrical arrangement of Mr. Gluckman, but were compelled to abandon it.

In February, 1861, a French Commission of Inquiry reported that an electrical communication only would solve the problem, but were not in favour of giving the power of communication to the passengers. The Chemin de Fer du Nord, however, fitted up all their carriages with the electrical apparatus.

In 1864, a sub-committee of railway managers met to consider "the possibility of adopting some means of communication between the different parts of a train whilst in motion," and in April, 1865, they issued a report in favour of giving passengers the power of communication. In this year (December, 1864) Messrs. Preece and Bidborough patented an electrical system of communication, and were followed in January, 1865, by Mr. Walker, whose system has been working on the South Eastern Railway, and shortly after Messrs. S. A. Varley and Martin, whose system has worked on the London and North Western for about two years; being ultimately withdrawn.

In 1867 the Passenger and Guard Communication Act was passed.

This succeeded the Railway Regulation Act, which made it compulsory on the part of railway companies to provide and maintain in good working order in every train running more than 20 miles without stopping, an efficient means of communication between the passengers and the servants of the company in charge of the train.

In 1870 the President of the Board of Trade gave his provisional sanction to the use of the cord, "The Board of Trade reserving to themselves the powers of reconsidering the question in the event of the system proving defective when tried on an extensive scale." This sytem having been tried for several years, its failure as a means of communication when resorted to on several occasions, led to an official investigation in 1871, and on July 15th, 1872, to the withdrawal of the provisional sanction, and the Board of Trade asked railway companies to adopt some other system they thought satisfactory.

This, then, is the present state of matters. Let us now consider what are the requirements of a perfect system of communication, and what conditions should be fulfilled.

1st. The machine should be perfect.

2nd. Strong, and not liable to get out of order.

3rd. Inexpensive both as to cost and maintenance.

4th. Easy of access and simple in operation.

5th. The introduction of foreign carriages should not interfere with its working.

And Lastly. It should be detective.

These, then, we take it, are some of the important considerations in relation to the question before us this evening.

Let us apply to these tests the two kinds of communication before the public, viz., the electric and the cord.

WITH REGARD TO THE ELECTRIC.

We all know the liability of electricity at times to be beyond the power of man. The nicety and delicacy requisite to preserve an effective working condition ; the expense of fitting up and keeping in order, and of technically educated men to keep it in order : the liability of thunderstroke interfering with the working, and rendering it inoperative at any minute when all other things may be in order.

WITH REGARD TO THE OTHER SYSTEM, THE CORD AND GONG.

This system can scarcely be called a novel one, and it seems to have every objection without any advantages accruing to it. We are all aware the cord is a nuisance whichever way we view it First of all, few know where to find it, whether inside or outside the carriage, and when found we may have the same fate as Captain Tyler, who, on one occasion, is stated to have drawn in eighteen yards of cord without making any signal ; then how liable it is to become jammed in the pullies, or to come off altogether ; and what great power it requires to pull the rope taut owing to its weight and friction, whilst it easily may be cut, or broken intentionally or accidentally ; its cost is far from small, nearly as much as the electric arrangement, and, finally, it has the great objection of being *non-detective* I may here state that in 1868, on the London and North Western railway, there were 2,300 carriages, and at £3 12s. 0d per carriage, the cost for fitting up one of the electrical systems would be £8,301 11s 0d , and that in 1871 it was estimated that the cord for the same railway company would cost £6,238 7s 6d , or only one-fourth less

I have now the honour to present for your consideration a third mode of communication, and that is the pneumatic one. Perhaps I cannot do better than read you the final specification of the patent, which is as follows, omitting a few not important sentences :—

NEW PNEUMATIC SOUND-SIGNAL SYSTEM

On the tops of the carriages (though other positions may be adopted if desired), iron or other tubing for air (gas tubing for instance) is secured with branch pipes passing through the tops of and into the carriages, and having compressible air balls or bellows arrangements attached. The ends of the said tubing dip down to provide for the coupling of the tubing of one carriage to the coupling of another, so as to make the tubing throughout the whole train one continuous air tube or passage, whereby whistles or other sounders placed close to the guard and the engine driver, can be sounded by pressing the said air balls or working the said bellows. The provision for coupling consists in having the ends of the iron tubing threaded (if required) or suitably constructed, and by having a coupling piece of brass or other metal screwed or fitted therein or thereto, such piece being peculiarly formed with an indented part, and having above a projecting part to which a forked hook is secured, with a ball or weight for pressing the same home to its position. And in order to render the coupling more perfectly effective, the india rubber tube has its end externally thickened or flanged, so that the forked hook may take its place immediately beneath the thickened part or flange, and so maintain the rubber tube in its place notwithstanding the motion of the train. Coupling is effected by the above arrangements or any substantially the same in effect, such as the following :—One end of india rubber tubing is attached to tube on the carriage, the other end being attached to the coupling made of a circular piece of wood, metal, or other suitable material, formed with grooves or openings and projecting pieces, such coupling being on each end of the carriage. When, therefore, two carriages are required to be coupled, the projecting pieces on each are let into the grooves or openings, and then turned and held firmly together by means of a flange made on the projecting pieces, by which means coupling of the tube is effected. The india rubber tubing is likewise provided with a projecting piece, with an orifice in it to take in a hook to be secured to the end of the railway carriage, so as to attach thereto the india rubber tube and to prevent it being lost when being uncoupled.

After the reading of the paper the Chairman invited discussion, and in response,

Mr. Murray said he would like to know in what position the pipe that ran from carriage to carriage was situate.

Mr. Roe said that the pipe should be placed along the centre of the carriage, so that if a carriage were turned end for end a continuous connection would still be made. It could, however, be placed at the side, but if it were placed at the side the difficulty of coupling when turned end for end would be raised, though, by being at the side, it would in no way interfere with the doors of the carriages.

Mr. Bell observed that if it were intended to put the signal where the lamp was generally found, where would the lamp be placed ? He assumed that Mr. Roe did not intend discarding the lamp altogether. Would it not be possible to have both lamp and signal in the centre of the carriage ? He thought the lamp should still be placed in the middle, and to place the alarm in the middle would, he thought, he objected to. He would like to ask what was the estimated cost of fitting this apparatus.

Mr. Murray said, as regarded Mr Bell's observation, that his (Mr. Murray's) idea was that the invention had better be placed at the side of the carriage, and not at the top, so that it would, if it were placed at the side, be low down and got at easily, and this would prevent the necessity of the signal-giver jumping up.

Mr Roe, in reply to Mr. Bell, said that he thought the best place to adopt was where it could be best got at, and this, he thought, was the centre of the carriage As regarded Mr. Murray's remark, he would state that his proposition involved the same objection as the cord principle, namely, that very few people would know where the alarm was. As regarded the cost of fixing, &c., he could not exactly say what it would amount to, though he thought it would not exceed one pound per carriage ; but the cost would be materially lightened when a large number of carriages were to be fitted. One great objection raised against the cord system was overcome by this invention, for no cord was necessary, and all that was to be seen was the handle, and the bellows being fitted outside, it was impossible for any tampering to take place, and by this system all danger was reduced to a minimum.

A gentleman here observed that he could see by this invention there was no chance of cutting or disconnecting, but he would like to know whether more than one signal was given.

Mr. Roe said that three signals were given, and the indicator outside the carriage would show from what compartment the signal proceeded.

Mr. Varley thought that the invention was one that deserved careful consideration. Certainly some reliable system was wanted in these days of railway accidents. One thing that struck him in regard to this invention was whether the air in the bellows would be sufficient to exert the force necessary for giving the signal, and also that some allowance should be made for leakage at the junctures of the carriages. These points were of great consequence in case of long trains; and again, in case of a breaking away of part of a train, there would be no means that he could see that would enable the driver to

ascertain or know that such a mishap had taken place. He thought that some means should be devised to meet this contingency, such as a cord running side by side with the air pipe, so that if a part of the train should happen to break away such would be indicated by striking a bell on the engine to which the cord was attached. He had been greatly interested in the means for securing the communication between passenger and guard, but more particularly with reference to the electrical system of communication.

Mr. Bux stated in regard to the indicating the breaking away of part of a train that there would be one great objection to the mode proposed by Mr. Varley, that such a system would create delay in coupling, and also that there would be difficulty in accomplishing that object.

The CHAIRMAN (Mr. Harris) observed that he had travelled a good deal in many countries, and, with regard to America, the system of communication was a slack cord hanging from the centre of the carriage, and all that was required to signal was to pull the cord; but then the construction of rolling stock in America rendered any elaborate system of communication unnecessary in consequence that through communication was available by reason of the construction of the cars, for a passenger, if he chose, could walk from one end of the train to the other, and if the train were to break the driver would instantly be made aware of that fact; but in this country it was another thing and it was essential that some reliable mode of communication should be adopted, and he thought that the invention before them was one that recommended itself to the careful consideration of railway directors and those in authority in regard to railway matters. He had to propose that a vote of thanks be given to Mr Roe, coupling also that of the inventor, Mr G. Stapleton.

Mr. MURRAY seconded the vote of thanks, which was carried.

A vote of thanks to the Chairman, proposed by Mr. CAMPIN (the Secretary) and seconded by Mr. ROE, was put and carried.

The meeting then separated.

PHYSIOLOGY OF THE SIAMESE TWINS.

DR. HOLLINGSWORTH, of North Carolina who examined the bodies of the Siamese twins at the time of their decease, found the band which connected them to be an extension of the sternum, for about four inches in length and two in breadth. The band was convex above and in front, and concave underneath. The two bodies had but one navel, which was in the centre of the band, and it is supposed that there were two umbilical cords branching from this, one extending into each body. The connecting link was found to be the ensiform cartilage, and was as hard as bone, and did not yield in the least. (It may be here mentioned that, for some time previous to their death, no motions were observable in the band.) The doctor said that he did not think they would have survived a separation, not from the fact of being afraid of separating the arteries, but from fear of producing peritonitis. No hæmorrhage would have been produced, so far as could been seen, as there were no arterial connections of any account.—*Scientific American.*

THE LONDON AND PROVINCIAL BOILER INSURANCE COMPANY, LIMITED.—This is the title of one of the new companies located at Leadenhall-street, E.C., London, now in course of formation. The insurance of boilers, and increase of safety in use of them, which are the professed objects of this company, are of the very highest importance, as Manchester folk have long acknowledged. The parties connected with the company seem to be of high respectability; we may therefore look for its successful progress.

Proceedings of Societies.

ROYAL SOCIETY.

JANUARY 22ND.—The President in the chair.—The following paper was read.—"On the Nature and Physiological Action of the Poison of Naja Tripudians," by Dr Brunton and Dr Fayrer.

January 29th.—The President in the chair.—The following papers were read. "Contributions to the Normal and Pathological Anatomy of the Lymphatics of the Lungs," by Dr Klein,—and "On the Comparative Value of certain Geological Ages (or Groups of Formations) considered as items of Geological Time," by Prof. A. C. Ramsay.

February 5th.—The President in the chair.—The following papers were read. "On the Anatomy and Habits of the Genus Phronima (Latr.)," by Mr J. D. Macdonald; —"On a Self-recording Method of Measuring the Intensity of the Chemical Action of Total Daylight," by Professor Roscoe,—and "Contributions to the History of Explosive Agents," Second Memoir, by Mr. F. A. Abel.

GEOGRAPHICAL SOCIETY.

JANUARY 26TH.—The Right Hon. Sir H. Bartle Frere, K.C.B., President in the chair.—The following new Fellows were elected:—C. F. R. Allen, Capt. L. N. P. Ames, W. M. Bell, Capt. H. F. Blair, W. Boyd, G. Bridgeman, C. G. Brown, I. R. Buchanan, Dr Bushell, W. Cartwright, H. W. Cholmley, Lieut.-Col. E. S. Daniell, D. Davidson, E. Dowling, W. Fell, Commander O. A. Foreman, Lieut W. J. Gill, J. H. S. Graham, E. Harby, Capt F. Hambley, Dr S. S. Heard, Lieut.-Col J. Hills, Dr J. Kennedy, A. J. L. Learmouth, D. H. Macfarlane, S. Mason, C. E. Matthews, Lieut.-Col A. Pearson, R. Powys, J. Reynolds, J. L. Redpath, E. Routledge, R. Smith, Duke of St. Albans, T. Waters, R. Wharton, H. E. Wodehouse, C. E. B. Young.—The paper was "Geographical Notes of the Khedive's Expedition to Central Africa," by Lieut. J. A. Baker, R.N. The author, who accompanied his uncle, Sir S. Baker, throughout his late expedition, gave in this paper the details of his geographical observations, which related chiefly to the obstructions caused by aquatic vegetation to the navigation of the main stream of the Nile, and to the reported connection between lakes Albert, Nyanza, and Tanganyika. The information received by Sir Samuel and his party regarding the latter point, was from native traders, who said they had travelled by boat from one lake to the other, by a tortuous channel, through which it is necessary to be piloted by persons who are acquainted with the intricacies of the navigation. In the discussion which followed, Sir S. Baker reminded the meeting that the observations of altitude taken by Livingstone in the southern part of Tanganyika, and by himself on the Albert, showed very nearly the same elevation for the two waters, and he reconciled the fact observed by Stanley of the inflow of the Rusizi on the north of Tanganyika, by the fact that the rainy season occurred at different times in the two lakes, and that the water flowed sometimes towards one lake and at other times towards the other.

February 9th.—The Right Hon. Sir Bartle Frere, K.C.B., President, in the chair.—The following Fellows were elected. Capt. P. C. H. Clarke, Lieut.-General R. F. Copland-Crawford, Capt. T. W. Goff, Hon. R. H. Manners-Sutton, Col. F. Tighe, Rev. J. Davis, Messrs. C. G. Barclay, J. Bray, S. Bristow, J. B. Brown, A. Folkard, H. C. Forde, W. T. Hunt, M. F. Keller, G. Knowles, C. R. Marten, W. F. Scholfield, and R. Stewart.—The paper was, "A Journey Outside the Great Wall of China," by Dr. S. W. Bushell. The route taken was north-westerly through inner Mongolia to Kalgan, and thence north-easterly to Dolonnor (a large town whose exact position was previously unknown), and Shang-tu, the old northern capital of the Yuen dynasty, described in glowing terms by Marco Polo. The ruins of Shang-tu, built by the famous Kublai-Khan, were identified by the existence of a marble tablet, with an inscription of the thirteenth century. It is the place referred to by Coleridge in the lines—

> In Xanadu did Kublia Khan
> A stately pleasure dome decree, &c.

The author found the site a complete desert, overgrown with rank weeds and grass, the abode of foxes and owls, which prey on the numerous prairie rats and partridges. The walls of the city, built of earth, faced with unhewn stone and brick, are still standing, but are more or less dilapidated, and the enclosed space is strewn with blocks of marble and other remains of large temples and palaces, while broken lions, dragons, and the remains of other carved monuments, lie about in every direction, half hidden by the thick and tangled overgrowth. From Shang-tu the author travelled south-easterly, past the great enclosed park called the Imperial hunting grounds, to the city of Jehol, and thence to Pekin. A second paper was read, by Mr. G. Phillips, entitled "Notices of Southern Mangi."

GEOLOGICAL SOCIETY.

JANUARY 21ST.—Prof. P. M. Duncan, V.P., in the chair.—Messrs. E. Gilpin and T. R. Mellor were elected Fellows.—The following communications were read:—"Extract of a Despatch from Mr. Williams, H.M.'s Consul at Samoa, dated Sydney, Oct. 24th, 1873." "The Secondary Rocks of Scotland. Second Paper, On the Ancient Volcanoes of the Highlands and their Relations to the Mesozoic Strata," by Mr. J. W. Judd; and "Remarks on Fossils from Oberbury, Styria," by Mr. A. W. Waters.

February 4th.—The Duke of Argyll, President, in the chair.—Messrs T. Stevenson, H. Fisher, M. Delmard, and J. D. Kendall, Corporal W. Parsons, R.E., and Col W. Boyle, were elected Fellows.—The following communications were read: "The Physical History of the Valley of the Rhine," by Professor A. C. Ramsay, and "On the Correspondence between some Areas of Apparent Upheaval and the Thickening of Subjacent Beds," by Mr. W. Topley.

CHEMICAL SOCIETY.

FEBRUARY 5TH.—Prof. Odling, President, in the chair.—"A Preliminary Notice on the Action of Benzyl Chloride on the Camphor of the Laureæ (*Laurus camphora*)," by Dr. D. Tommasi, was read by the Secretary.—Dr C. R. A. Wright had a paper "On the Isomeric Terpenes and their Derivatives, Part III., on the Essential Oils of Wormwood and Citronelle," being a detailed account of his experiments on these substances, a preliminary notice of which was communicated to the Society some time since. The other communications were, "A Preliminary Notice on the Perbromates," by M. M. Pattison Muir,—and "On the Coals from Cape Breton, their Cokes and Ashes, with some Comparative Analyses," by Dr. H. How, the latter paper giving the amount of coke produced by slow and quick coking, from the main seam coal of Sydney Mine, Nova Scotia, and the Lingan Coal, also analyses of the ashes left by these coals.

MICROSCOPICAL SOCIETY.

FEBRUARY 4TH.—Anniversary Meeting.—C. Brook, Esq., President, in the chair.—Mr. J. S. Crisp was elected a Fellow, and numerous donations were announced.—The Report of the Council and the Treasurer's Statements of Accounts were submitted and adopted, and the Officers and Council for the coming year was elected. The Annual Address to the Society was delivered by the

President, in the course of which, after reference to their present position and future prospects, he gave a critical review of the most important papers brought before their notice during the year; alluded to the microscopical apparatus exhibited at the Vienna Exhibition; and concluded with obituary notices of Fellows deceased since the last Annual Meeting.—The following gentlemen were elected as Officers and Council: *President*, C. Brooke, M.A.; *Vice-Presidents*, Dr. R. Braithwaite, J. Millar, W. K. Parker, and F. H. Wenham; *Treasurer*, J. W. Stephenson; *Secretaries*, H. J. Slack and C. Stewart: *Council*, J. Bell, F. Crisp, Dr. W. J. Gray, J. E. Ingpen, S. J. M'Intire, H. Lee, W. T. Loy, Dr. H. Lawson, H. Perigal, A. Saunders, C. Tyler, and T. C White.

VICTORIA (PHILOSOPHICAL) INSTITUTE.

At a recent meeting of this Institute which took place at its rooms, 8, Adelphi-terrace, C. Brooke, F.R.S., in the chair, several new members were elected, and donations to the library announced from Dr Lionel Beale, Professor Dawson, and others, after which it was stated that the number of members elected last year had been 110, a number slightly in excess of that in the year 1872. A paper by the Rev. J. H. Titcomb, on "Magnitudes in Nature, and their Bearings on Biblical Interpretation," was then read, in which the latest discoveries in geology and astronomy were reviewed, and shown to be in no way at variance with what a careful student of Holy Writ would be led to expect. At the conclusion of the paper, one by Professor Challis, F.R.S., criticising some portions of the arguments, and advancing several others, to strengthen the position taken by Mr. Titcomb, was read; as also communications from the Radcliffe observer, Professor Pritchard, and the Astronomer Royal's department, bearing upon and supporting the arguments derived from astronomy. The latter stated, "In regard to the central point of the Solar System, that the evidence of the spectroscope, so far as it went, seemed to confirm the supposed motion of the Solar System towards Hercules, and that it appeared probable that the centre of motion of the Solar System was somewhere in the direction of Alcyone." An animated discussion ensued. On Monday February 2nd, Mr. Howard read his paper on the contrast between "Crystallization and Life." Fourteen new members were also elected.

ZOOLOGICAL SOCIETY.

FEBRUARY 3RD, 1874.—Dr. E. Hamilton, Vice-President, in the chair. The Secretary read a report on the additions that had been made to the society's menagerie during the month of January, 1874, amongst which were specially noticed a female water-deer (*Hydropotes inermis*), a pair of pink-headed ducks (*Anas caryo-phyllacea*), and a dusky monkey (*Semnopithecus obscurus*), acquired by purchase, and two vulturine guinea-fowls (*Numida vulturina*), presented by Dr. J. Kirk, C.M.Z.S. An extract was read from a letter addressed to the Secretary by Mr. Luigi M. L. Albertis, C.M.Z.S., containing an account of a new species of kangaroo, of which he had lately obtained a living specimen from New Guinea, and which he had proposed to call *Halmaturus luctuosus*. Dr. Cobbold communicated the second part of a series of papers entitled "Notes on the Entozoa;" being observations based on the examination of rare or otherwise valuable specimens contributed at intervals by Messrs. Charles Darwin, Robert Swinhoe, Charles W. Devis, the late Dr. W. C. Pechey, Dr. Murie, and others. Mr. Garrod read a paper in which he proposed a new classification of birds, founded mainly on the disposition of their muscles and other soft parts. The five muscles which he had observed to vary most were the ambiens, the femoro-caudal, the accessory femoro-caudal, the semi-tendinosus and the accessory semi-tendinosus. After stating which of these are present or absent in the different families of birds, he showed that the presence or absence of the ambiens muscle is so intimately correlated with other characters that a division of the whole class into *Homalogonati* and *Anomalogonati*, depending on that peculiarity, would stand the test of much criticism. The homalogonatous birds were divided into the galliformes, the anseriformes, the ciconiiformes and the charadriiformes; the anomalogonateous into the passeriformes, the piciformes and the cypseliformes. Among the most important changes proposed or substantiated were the placing *Serpentarius* and *Cariama* with the otididae, the cypselidae with the trochilidae, and the musophagidae among the galliformes.

February 17th.—George Busk, Esq., F.R.S., Vice-President, in the chair.—Mr. Busk exhibited some skulls of the tiger and leopard from China, procured by Mr. R. Swinhoe, and showed that those from the northern and southern provinces did not appear to be specifically distinct. A communication was read from Mr. L. Taczanowski, Conservator of the Museum of Warsaw, containing the descriptions of 24 new birds, obtained by Mr. Constantine Jelski in Central Peru. Amongst these was a new Cotingine form, proposed to be called *Doliornis sclateri*, and the four new humming birds, named respectively *Metallura Hedvigae*, *Helianthea dichroura*, *Eriocnemis sapphiropygia* and *Lampraster branickii*. A communication was read from Sir Victor Brooke, Bart, describing a new species of gazelle, founded on two specimens living in the Society's Menagerie, which he proposed to call *Gazella muscatensis*. A communication was read from Dr. T. Schomburgh, Director of the Botanic Gardens, Adelaide, containing an account of the habits of the Australian coote (*Fulica australis*) as observed in the Gardens under his charge. Mr. E. Ward, F.Z.S., exhibited the head of a supposed new species of wild sheep, from Ladak, which he proposed to name *Ovis brookei*, after Sir Victor Brooke. Dr. J. E. Gray, F.R.S, communicated some notes on the crocodile of Madagascar, which he proposed to distinguish from *Crocodilus vulgaris* of Continental Africa, and to call *Crocodilus madagascariensis*. A communication was read from Mr. W. N. Lockington, of Humboldt County, California, containing some notes on the mammals and birds met with in that part of the State of California.

INSTITUTION OF CIVIL ENGINEERS.

FEB. 3RD. Mr. T. E Harrison, President, in the chair.—Forty-one candidates were elected, including five members, viz.: Messrs. J. C. Bailey, W. Bell, W. Foulis, A. Moncrieff, and M. Paterson. Thirty-six gentlemen were elected associates, viz: Major W. Crossman, Major-General H. Y. D. Scott, Messrs. H. Barratt, H P. Boulnois, E. B. Bright, M. Bromley, W. A. Brown, G. H. Chubb, W. Conyers, W. Cooper, C. Copland, A. L. Cousins, J. Douglas, S. J. Dunlop, J. H. Eykyn, J. E. Fisher, J. E. Hannah, C. W. E. Henslowe, R. R. P. Hickson, W. F. Howard, J. Jackson, P. T. S. Large, J. E. Lowe, J. M'Ritchie, F. G. Mann, J. Menzies, J. Penn, R. Pinchin, W. H. Roberts, W. H. Stanger, J. Strachan, L. Trench, G. A. Twynam, E. H. Vernon, P. L. Weatherhead, and C. G. Wilson. The Council had recently admitted the following candidates as students, viz.: Messrs. H. O. Baldry, C. W. Scriven, A. H. Thompson, and H. J. Tingle.—The paper read was, "Description of the Brighton and Hove General Gas Company's Works, Portslade, Sussex," by Mr. J. B. Paddon.

February 3rd, 1874.—Thos. E. Harrison, Esq., President, in the chair.—The paper read was a "Description of the Brighton and Hove General Gas Company's Works, Portslade, Sussex," by Mr. John Birch Paddon, M. Inst. C.E. The election of the members before-named took place at the monthly ballot.

February 10th.—T. E. Harrison, Esq., in the chair.—The paper read was, "On the Construction of Harbour and Marine Works, with artificial blocks of large size," by Mr. B. B. Stoney. [This paper will be found in another page.]

ROYAL INSTITUTION.

FEB. 2ND.—The Duke of Northumberland, D.C.L., President, in the chair.—The Lady Claud Hamilton, the Right Hon. G. J. Goschen, the Rev. F. Braithwaite, Messrs. R. S. Faulconer, H. F. Harwood, S. H. Harwood, R. J. Taylor, and J. C. Zambra were elected members.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

FEBRUARY 3RD.—Sir H. Rawlinson, K.C.B., D.C.L., F.R.S., in the chair.—The following paper was read for the author by Mr. R. Cull: "On the Astronomy of the Assyrians, with Translations from the Cuneiform Inscriptions," by the Rev. A. H. Sayce, M.A.

ANTHROPOLOGICAL INSTITUTE.

JAN. 27TH.—Anniversary Meeting.—Professor Busk, President, in the chair.—The President referred to the finances of the institute. Although the receipts are adequate for the necessary expenditure on the present economical principles of management, they do not allow the society to pay off more of the debt or to enlarge the scope and usefulness of the institute. Until the indefensible secession of members early in 1873 on a purely personal question, the institute, since its formation, had paid off the combined debts of the two old societies at the rate of £100 a year. He appealed to the members to make a united effort to extinguish the debt of £800. A year's income would do it. The President further announced that nearly £250 had been promised by members present at a council meeting held that day, provided the sum of £500 be contributed by other members of the institute. The President then delivered the annual address, in which he viewed the work done during 1873 by English and foreign anthropologists. Amongst a large number of topics, he adverted at considerable length to the important contributions to craniometry by Dr. H. Von Jhering and Dr. P. Broca, criticising the respective methods employed by those distinguished anthropologists; and concluded that part of his address with the observation that the study of craniology is almost futile when applied to highly civilised, and, consequently much mixed, peoples, and that its results are the more certain in proportion to the purity of race; that purity at the present time was rapidly disappearing, and with it the surest data for the determination of the problems involved in the antiquity and physical origin of man. The following officers and council were elected to serve for 1874:—President, Professor G. Busk; Vice-Presidents, J. Evans, Colonel A. Lane Fox, A. W. Franks, F. Galton, Professor Huxley, and Sir J. Lubbock, Bart.; Director, E. W. Brabrook; Treasurer, Rev. D. Heath; Council, Dr. J. Beddoe, W. Blackmore, H. G. Bohn, Dr. A. Campbell, Hyde Clarke, Dr. J. B. Davis, W. Boyd Dawkins, R. Dunn, D. Forbes, Sir D. Gibb, Bart., G. Harris, J. P. Harrison, J. F. M'Lennan, C. R. Markham, F. Ouvry, F. G. H. Price, J. E. Price, F. W. Rudler, C. R. Des Ruffières, and E. B. Tylor.

DISTRESS AND OTHER PYROTECHNIC SIGNALS.—Experiments have been instituted in the Crystal Palace Grounds by Messrs. Brock and Co., of Nunhead, on the above subject.

KILN BUILDING.

George Cowdery, of Exmouth, Devon, has recently patented improvements in the manufacture of bricks or blocks useful for the improved construction of buildings of various kinds, the improved construction of kilns forming part of the said invention. In his specification he states:—

I form with clay or brick earth, *hollow* bricks or blocks which I term terra ashlar builders. These I make of any suitable size, say 2ft. 3in. long, 9in. deep, and 14in. wide, whereby I reduce the weight of 14in. brick-work about two-thirds. In order to properly dry and burn these bricks, I construct drying rooms, and kilns, or ovens, the drying rooms deriving their heat from the kilns, which I prefer to construct in a circular form, having continuous ring-form burning chamber, or chambers, and a drying room outside the kiln, but heated therefrom (usually from the burning chamber); the heat passing with the smoke beneath the floor of the drying room, and escaping up the chimney, situate at the end of the drying room. The central space encompassed by the ring formed, or continuous burning chamber, is occupied by a drying chamber or room, which is also connected to the outer drying room by pipes or ducts in communication with the flue for conveying heat to the said outer drying room. In erecting buildings with these blocks, air should be admitted near the surface of the ground, say, by perforations in the plinth, and free circulation be obtained between the walls of blocks, with outlet round each flue on the top of chimney, and as there will be only about 1½ inches thickness of blocks at back of fire-place, the air between the building blocks becomes warmed, and makes its exit round each flue as before named, carrying the smoke clear of flue, thereby preventing down draught. When my improved construction is adopted, in the event of adjoining premises being on fire the partition wall would become heated, but as fresh air is admitted at the bottom of the building, it would rapidly carry off the heated air, thereby preventing contact.

For greater safety, I would recommend the use of revolving iron shutters to all windows, as also the kyanising of all timbers used in building, by which means fire from within would not spread. Although I have described my invention as a whole, it will be evident that parts can be used separately, for instance, for plinths, quoins, string courses, window and door heads and jambs, cornices, garden walls, and so forth; and the drying rooms and burning kilns can be also used for pottery, common brick making, lime, and so forth.

GADD'S STEAM GENERATING INVENTION.

The methods that have been hitherto employed for the combustion of oils of various kinds for the generation of steam and other purposes, have, for the most part, either conveyed the oil to the furnace on fluted bars, have converted it firstly into gas in retorts, or have projected it into the furnace by means of a jet of steam or air, acting as a blow pipe; by means of which the oil is carried in a spray form along the flues, and by combustion converted into flame. Of these various methods, the last seems to offer the best chances of success; but by this means great waste results when the oil pipe is inserted into the nose of the blow-pipe near its orifice, as great quantities of oil become blown through the furnace without having been burnt, or go off in smoke, and when this is sought to be remedied by allowing the oil pipe to run inside the steam pipe some distance, say, beyond a few inches for the purpose of volatilising the oil in some measure, it is found that the more solid portions of the oil sought to be used choke up the passages, and so stop the working.

The object of Mr. Gadd's improvements is to remedy these defects, for which purpose he allows the oil not only to enter the steam pipe or chamber, but to mix or become in suspension with the steam at a convenient distance from the orifice or orifices opening into the furnace or flue. And along this furnace or flue, by preference, he fixes, in connection with the steam pipe a perforated pipe, or pipes, or chamber, from which perforations the oil charged steam will be emitted in various directions, so causing a number of jets to impinge upon the boiler flue of bottom (according to construction) or the furnace crown. By which means a greater separating or diffusing of the oil takes place than when a simple jet carries the oil along the length of the furnace or flue. Or the steam may be charged with oil by allowing the steam to pass through a vessel or pipes containing the oil. To provide further against the waste of any portion of the oil that may escape combustion in the first instance, he adopts the following methods. Either he covers the bottom of the furnace with "asbestos," or with a vessel or tank of water which will catch the unconsumed oil when it falls and retain it until it has time for proper combustion. The oil may also be burnt by projecting the same into, through, or on to the water or "asbestos," direct, or in combination with steam by any suitable means. The inventor and patentee is Mr. W. Gadd, of Manchester.

TO INVENTORS.

C. E. G., in the *Scientific American*, lays down the following maxims for the guidance of inventors:

1. Know definitely what you want to accomplish, stick to it, and let other matters go, for the time.

2. Post yourself thoroughly as to the laws governing the action of each part of your machine.

3. Always bear in mind that whatever is gained in time is lost in power, and *vice versa*.

4. Think over every machine, of a nature similar to yours, which you have seen; and when your idea is clear in your head, compare it with those of inventors who have preceded you in the same line.

5. Be sure that the cost of your device will not prevent its use.

6. Avoid all complicated arrangements; *make every machine of as few parts as possible.*

7. Imagination, judgment, and memory are the faculties to employ. Imagination will bring forth new forms and actions, judgment will compare them with other devices and determine their relative value, and memory will store up the results for future use.

CHEMICAL NOTES.

Under this head the *Athenæum* states that Prof. Hermann Vogel contributes to the *Berichte der Deutschen Chemischen Gesellschaft zu Berlin*, some notes "On the Sensibility of the Bromide of Silver to Light, especially to the Chemically-inactive Colours." He maintains that the bromide of silver is sensitive to rays of light which have hitherto been thought to have no photographic action, and, that he finds the bromide of silver, when dry, is more sensitive to the less refrangible of the visible rays of the solar spectrum, but, when moist, to the *more* refrangible rays. He thinks it possible to render the bromide of silver sensitive to any desired ray of the spectrum. He publishes this as a new discovery, although Sir John Herschel, in his memoir "On the Action of the Rays of the Solar Spectrum," published in the *Philosophical Transactions*, 1840, says of the bromide of silver, "But the most characteristic peculiarity of the spectrum is its extravagant length. Instead of terminating at the mean yellow ray or thereabouts, the darkened portion extends down to the very extremity of the visible red rays;" and Mr. Robert Hunt, in his "Researches on Light," 1844, shows that this salt is affected by nearly all the rays; and in the second edition, in 1854, he writes, "As soon as the prismatic spectrum falls upon paper prepared with this salt (bromide of silver), it blackens over the whole extent of action with nearly equal intensity." Continental chemists are often curiously ignorant of the labours of their English brethren.

It is well known that solutions of many salts of ammonia, though originally neutral or even alkaline, become more or less acid in their re-actions as they slowly evaporate. This curious decomposition has been lately studied by Dr. Dibbits, of Amsterdam, who has published a paper "On the Dissociation of Ammonium Salts in Solution in Water."

Dr. Schrauf has laid before the Academy of Sciences of Vienna a monograph on those basic sulphates of copper which occur in native forms, and are grouped together under the general name of Brochantite. After an elaborate description of the chemical and morphological characters of these minerals, he discusses the re-actions by which compounds of similar constitution may be obtained as laboratory products, and refers to the experiments of Mr. Field and other chemists who have conducted investigations on this subject.

EXHIBITION OF APPLIANCES FOR THE ECONOMICAL CONSUMPTION OF FUEL.

This exhibition, inaugurated by the Society for the Promotion of Scientific Industry, a young association, which, if it has not brought to the front all the most modern ideas on the subject of coal economy, is, nevertheless, most certainly deserving of credit for having made a very satisfactory start in the right direction, and for having provided the public of Manchester and Salford with an exceedingly interesting exhibition.

Space now at our disposal will not admit of an extended report in the present issue; but we hope in a future number to lay before our readers the principal points of interest, and the lessons to be drawn from the collection of apparatus, brought together in the large wooden shed at Peel-park, Salford. As far as we have yet been able to notice, the exhibitors belong chiefly to Lancashire and Yorkshire, so that the thought which is represented may be considered more or less of a local character.

The nature of the exhibits consist of what are technically known as "*economisers*," that is to say, various *arrangements* for utilising the waste heat from steam boilers and other furnaces, as applicable to steam engines, for reducing the use of steam to the minimum; of fire-bars for furnaces, with a view to the economical consumption of coal; of peat and peat compositions, with other artificial fuels, of new forms of boilers, tubular and otherwise, of machinery for winning coal from mother earth, and lastly, of numerous forms of stoves and firegrates for domestic purposes, not omitting a show of different arrangements for heating by means of gas.

The exhibition, which at first from a variety of causes attracted but little notice, seems to be steadily progressing in public favour; and great numbers of attentive students of the great fuel question may be now daily seen carefully and critically examining the various inventions there laid before them.

We shall return to the subject with pleasure; and, in the meantime, we heartily wish the committee every success in their endeavour.

We think it right to state that by the aid of Mr. W. Gadd, C.E., of Manchester, we are enabled to present the above to our readers.

APPLICATIONS FOR LETTERS PATENT.

(Continued from page 39.)

Coventry. Tools or machinery for turning, screwing, drilling, and boring.—J. B. Stearns. Electric telegraph apparatus.—S. Gould. Washing machines.—A. Pickup and S. Carter. Sewing machines.—G. W. Rendel. Mounting ordnance.—R. Wilson. Hydraulic presses, and steam engines for working the same, which engines are also applicable for working hydraulic hoists and cranes.—A. Nicols and J. F. N. B. Simons. Method of preserving animal and vegetable substances.—I. B. Harris. Hose and tubing.—I. B. Harris. Flexible tubing.—O. D. Renaudon. Ornamental surfaces applicable as coverings for courts and ways.

On November 28th.—3888 to 3901.—E. Allen. Glazing or burnishing leather.—E. Hawken. Appliances for economising the consumption of fuel.—J. Steel. Apparatus for actuating the brakes of railway trains by compressed air.—J. Lee. Telescopic street orderly bin for collecting refuse in the streets.—E. Diver, M.D. Obstetric apparatus. H. B. Sale and A. Martin. Stamp for marking or stamping paper, linen, and other textile fabrics. W. Hutchison. Steam engines.—W. Hodgson and F. Sea. Spinning and twisting wool and other fibres.—E. Dickinson. Apparatus for making the moulds for spur and other toothed wheels.—L. Chelot. Manufacture of nails, bolts, metallic wires, and other similar means of attachment or connection.—S. Bevan. Photographic and other albums, and reference and other books for turning over the leaves of the same.—A. V. Newton. Improved mode of finishing felted goods (com.) W. Fisken. Apparatus for heating or warming buildings, also for cooking purposes.—W. R. Lake. Machinery for drilling or boring rocks and hard substances (com).

On November 29th.—3902 to 3922.—R. Morton. Refrigerators or apparatus for cooling liquids, parts of which are applicable to distillation, surface condensation, heating or cooling fluids, air, or gases.—A. Pinney. Thermometers for bakers' and other ovens.—S. Alley and J. B. Handyside. Fastenings for connecting and strengthening the ends of rails for railways or tramways, and apparatus for applying the same. G. Edwards. Stoves.—H. Smith. Candle holders.—J. Hicks. Apparatus for saving life at sea.—G. Allibon and A. Manbre. Safety valves.—G. L. Shorland. Fire grates of kitchen ranges, also other descriptions of fire grates.—J. Bell, jun., and R. Bell. Utilizing waste heat of materials employed in retorts and apparatus employed therefor.—C. Slagg. Hearth box for collecting the fine ash of house fires, and separating the cinders therefrom.—G. L. Scott and W. E. Hayes. Cupolas and blast furnaces, or other furnaces used for similar purposes.—H. W. Hart. Shirts and other articles of wearing apparel.—W. T. C. Pratt. Safety apparatus for railway trains.—F. Brown. Register stoves or grates.—F. G. Underhay and A. E. Carter. Apparatus for preventing waste of water.—J. Noad. Envelopes for the protection of bottles and such like.—T. S. Monkhouse. Printing, and apparatus for cutting the printed matter at the same time.—W. R. Lake. Flash-light signal apparatus or night telegraph (com.)—H. Rahtjen. Antifouling and preservative composition for ships' bottoms and other submerged structures.—J. R. McVoy. Machine for cleaning and polishing boots, shoes, plate, and other articles.—J. R. Lancaster. Combination tool.

On December 1st.—3923 to 3940.—H. Bensley. Apparatus for stamping linen with name or initials.—E. Clarke, G. Clarke, and H. E. Harreld. For economising fuel and preventing smoke in furnaces for boilers, pans, and other heating or evaporating apparatus.—F. Lloyd. Fire grates and their appurtenances.—V. Chamben. Plough.—S. Johnson. Fire escapes by a lift.—J. Kenyon. Economising fuel in fire-grates or stoves for domestic and other purposes.—T. B. Williams. Apparatus for extracting the gases of smelting and other furnaces.—J. E. Beanland. Quadrants for opening, shutting, and fastening windows, and apparatus employed therein.—W. M. Beaufort. Method of making joints.—H. Hebert. Pianofortes and other keyboard instruments.—T. J. Smith. Apparatus for grinding and surfacing the exterior of cylinders, rollers, and drums (com.)—J. M. Plessner. Motive power engines.—W. H. Yeomans. Needle cases.—H. A. Egerton. Construction of ships, ferry boats, and other vessels.—J. H. Johnson. Treatment of sugar cane for the manufacture of paper pulp therefrom (com.)—J. H. Johnson. Polishing and glazing photographic proofs, and apparatus employed therein (com.)—B. T. Moore. Current meters, water meters, and ships' logs.—D. Greig and R. Burton. Apparatus for actuating steam ploughs and other agricultural implements.

On December 2nd.—3941 to 3955.—R. Russell. Stoves and kitchen ranges.—A. Smith and F. Field. Decolourizing of solid and liquid hydrocarbons, and the application of materials for that purpose.—E. Verdeau. A new electric pile, said Miguel's pile, to be used in the telegraphy, in the locomotion, and in the electrical lighting.—H. Bessell and J. A. Wheeler. Palliasses.—B. Hess, jun. Watches.—J. J. Perry and W. E. Wiley. Pens or marking instruments.—B. C. Lauth. Machinery for rolling iron and other metals (com.)—E. R. Morris. Pocket instruments for measuring and registering distances.—A. Kruger and T. Colani. Saccharification of grains.—A. Millar. Portable apparatus for scoring or registering numbers.—L. Bouttier and M. J. B. Conhault. Shears or clips for shearing or clipping sheep.—R. M. Manning. Railway breaks.—F. A. Paget. Mode of and apparatus for softening and purifying water (com.)—J. H. C. Zanzie. Combined garment.—J. Wyatt. Apparatus for signalling between the different parts of railway trains, and partly applicable for opening and closing the doors of railway carriages.

On December 3rd.—3956 to 3976.—W. E. Gedge. Button and novel process of button fastening (com.)—B. L. Thomson. Sheathing or covering ships' bottoms and other surfaces, and the plates to be employed therein.—J. Wilson. Cover or backing for books.—A. C. Henderson. Match-boxes for automatically lighting the matches (com.)—A. M. Dillet. Checking fares to be taken in omnibuses, cabs, and other public or private vehicles, and also for indicating the distance travelled by them.—W. T. Holland. Fettling for puddling and boiling furnaces.—W. Cunningham. Machinery for carding jute, flax, hemp, and other fibrous materials, and in part applicable to the delivering parts of other machinery.—C. Stuart, W. Jagger, J. Smith and J. Filling. Safety valves.—J. Clarkson. Fastening, connecting, or securing artificial teeth.—W. Adair. Fog Horns.—F. G. Pearson and J. Grinold. Manure and other similar forks.—C. Barton. Preserving or protecting, ornamenting, finishing, or emblazoning the whole or certain parts of locks and latches.—J. Cawthorn. Movable sashes and their frames.—J. Worrall. Machinery for finishing cut-pile fabrics.—W. E. Newton. Apparatus for signalling by night (com).—L. Oppenheimer. Tiles or slabs for floors or walls.—E. Pickering. Permanent way of railways.—B. F. Fuller. Printing press (com.)—B. F. Fuller. Automatic paper feeder for printing presses and other machinery (com.)—C. P. Weatherby. Process and apparatus for preserving wood.—J. E. Russell. Tucking devices and guides for sewing machines (com.)

On December 4th.—3977 to 3999.—W. Perch. Supplying compressed air to machines or apparatus for the purpose of obtaining motive power.—W. R. Lake. Welding iron and steel (com.)—S. Samuel. Construction of rolls for wool washing and other machinery, and for the purpose of pressing the moisture out of wool and cotton fibres, and also other materials (com.)—W. Tasker. Machinery for forming and welding and finishing couplings used for connecting steam, gas, and water pipes (com.)—E. Storey. Bed applicable for saving life at sea.—W. Jones. Apparatus for uniting, by sewing together or seaming, parts of looped knitted or other fabrics.—W. Whittle. Fire-places and the mode of heating ovens or apparatus used in cooking for domestic purposes.—T. Suffield. Foot warmers, carriage heating and bed airing apparatus.—P. Vigoureux. Manufacture of certain bituminous materials.—J. Barton. Fastener for windows. J. B. Delavault. Advertising envelope and combined letter paper.—J. Walch. Means for protecting the coverings of umbrellas, parasols, and similar articles.—W. R. Gedge. Embroidering machine, termed "Bonnaz couso-brodeur" (com.)—A. Reque. Proceedings in panification.—H. A. Bonneville. Means for using with the sewing machines the thread balls (com.)—A. Kaiser. Automatic balances to be used for weighing grains, farina, and other similar substances.—J. Mallison. [illegible] bleaching, mordanting, and dyeing yarn.—W. Ramsey. Glass cutting [illegible].—J. Searle. Lubricators. (Complete specification.)—J. Tweedy and J. Simpkin. Locking apparatus for controlling and working signals and points.—W. Hooper and J. M. Dunlop. Telegraph cables and covering telegraph conductors.—A. M. Clark. Folding chairs and other articles of furniture (com).—W. L. Andrews. Apparatus for obtaining and preserving equilibrium in ships' cabins, such cabins being available for saving life at sea in cases of wreck.

On December 5th.—4000 to 4014.—P. R. de d'Humy. Stoppers for bottles, &c.—T. G. Messenger. Pipe joints and couplings.—W. Southwood and C. Mathews. Propelling ships.—R. Heywood. Horse collars (com).—S. Hinchliffe. Machinery for flocking woollen or other woven or felted fabrics.—W. B. Radish. Fire-grates.—I. Careless. Horse collars.—J. H. S. Wildsmith. Artificial manure.—D. MacDowell. Churn.—L. D. Phillips. Fittings for the reception of saliva to railway carriages and other public and private carriages.—J. E. West. Trellis suitable for training vines or other trees.—P. Hubert, jun. Stoppering flasks, bottles, &c.—A. M. Clark. Material as a substitute for window glass (com).—H. Kenyon and I. Swindells. Manufacture of nitrogen and its application to the production of various articles.—M. Baerlein. Sizing, stiffening, and otherwise preparing yarn for weaving.

On December 6th.—4015 to 4031.—J. Norbury. Valve arrangements of hydraulic presses, &c.—T. Read. Boilers.—W. Mather. Apparatus used for the purpose of percolation or filtration of fluids or infusions, and the precipitation of bodies held in suspension in fluids (com).—J. Sheldon. Stretching the "tips" of felt hats.—E. C. S. Moore, R.E. Supplying fuel for combustion, the coal or other combustible material being supplied underneath the burning coal or other material, whereby economy is effected in its combustion.—F. Page. Moulding of artificial fuel when in a wet or pasty condition.—W. C. Taylor. Safety valves.—G. Hall. Securing knobs to spindles in door furniture.—D. Jones. Obtaining and applying motive power.—T. Lockwood and A. Chappell. Looms for weaving.—A. Walker. Hansom cabs.—F. Wirth. Ropes and carriages employed upon tramways (com).—J. H. Johnson. Treatment of wool, silk, and other animal textile materials, whether in a raw or manufactured state.—A. A. Welch. Feeding and watering cattle during railway journeys.—R. Okell. Harness for horses.—J. T. Parlour. Armour for ships, floating batteries, forts, and other structures.—G. Haseltine. Stitching books. (Complete specification).

On December 8th.—4032 to 4047.—R. Smith, W. Stephenson, J. Vere, and B. Capell. Capstans for fishing and other vessels.—M. B. Bouju. Oil.—H. Moore. Roadways or pavements.—M. McSherry. Fireplaces of cooking ranges.—C. J. Galloway and J. H. Beckwith. Steam boilers.—W. Lancaster. Transmitting variable speeds to revolving shafts or axles.—H. Cookey and F. C. Cookey. Gas stoves.—W. H. C. Stanford. Earthenware pipe joints.—W. R. Lake. Drawers for men and boys (com).—J. W. Scott. Stud buttons or lacing studs for boots, shoes, and other garments.—L. Turner. Looms for weaving elastic fabrics.—D. Dawson and C. Slater. Dyeing apparatus.—A. Waithman. Finishing twine.—T. C. Fawcett. Brick-making machines.—W. Sollers. Lawn mower. (Complete specification).—A. M. Clark. Mills for hulling maize (com).

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ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE.

APRIL 1, 1874.

PREVENTION OF ADULTERATION.

No. I.

THE "Act to amend the Law for the prevention of Adulteration of Food and Drink and of Drugs," which came in force on the 10th August, 1872, took many manufacturers by surprise. That some such measure was necessary for the benefit of the public cannot be questioned, but that one should have emanated from the infallible wisdom of the British Parliament, which is so inconsistent in principle, so vexatious to trade generally, so minutely meddling and peddling, and presented in so crude a form that (seeing it has to be administered by vestry boards and police magistrates and justices of the peace in a summary manner) is much better fitted for an instrument of pseudo-philanthropic tyranny than a measure of preventive jurisprudence, is very surprising.

Mr. Lowe, in addressing the electors of the University of London, plumed himself and Mr. Gladstone's Government on the various measures achieved during their period of office; and amongst the chief, expatiated largely upon the virtues of the Adulteration of Food Act: "it was to strike a blow at that dreadful adulteration which takes place in almost all articles of food chiefly sold to the poorer classes, it was to imprison the insatiable manufacturer, annihilate the unscrupulous trader," give us food and drink so pure that it would abolish the doctor; indeed, that such unadulterated diet should so influence our health that we would become a race far superior to anything Dr. Darwin has conceived for us in the future, or Lord Lytton pictured in his ideal world of the "Coming Race."

We certainly cannot congratulate either Mr. Lowe or Mr. Gladstone's Government on the passing of this measure, nor its final result in practical experience. This Act, like many during the last few years, passed the House when few members were assembled. Mr. Lowe's desire to cure a growing evil may be sincere, but his ideas of commerce both at home and abroad are much too superficial to legislate on matters so affecting the community at large. That Mr. Gladstone intended to adhere to the wording of the Act, in the face of all opposition, is clear, from his declining to receive the deputation from the "National Chamber of Trade."

The clauses which most fatiguingly affect the manufacturer and retail dealer are the following:—

"Every person who shall wilfully admix, and every person who shall order any other person or persons to admix with any article of food or drink, any injurious or poisonous ingredient or material to adulterate the same for sale, and every person who shall wilfully admix, and every person who shall order any other person or persons to admix, any ingredient or material with any drug to adulterate the same for sale, shall for the first offence forfeit and pay a penalty not exceeding fifty pounds, together with the costs attending such conviction, and for the second offence shall be guilty of a misdemeanour, and be imprisoned for a period not exceeding six calendar months with hard labour." 35 & 36 Vict., c. 74, s. 1; Section 2, which renders the sale with knowledge of anything so adulterated liable to twenty pounds penalty; and Section 3, which provides that "Any person who shall sell any article of food or drink or any drug, knowing the same to have been mixed with any other substance with intent fraudulently to increase its weight or bulk, and who shall not declare such admixture to any purchaser thereof before delivering the same and no other, shall be deemed to have sold an adulterated article of food or drink or drug, as the case may be, under this Act":—

Thus we have a most absurd confusion of utterly distinct classes of actions; for the wilful putting of any *injurious* or *poisonous* ingredients into any article or material, or trafficking with an article so adulterated, every right-thinking person will at once recognise as a fit subject for criminal punishment, it being analogous to manslaughter; whereas the admixture of harmless ingredients simply for the purpose of commercial advantage is an action which has really more of the nature of a civil injury than a criminal offence, at any rate, its criminality must often be lessened by its being done, as it frequently is, to meet the "loup for a cheap" notions of economy so commonly prevalent not as a money fraud. Moreover, although the real mixer or adulterator is liable to a heavy fine and imprisonment; yet, a person who *wilfully sells poisonous material* is liable to a smaller fine and nothing is said about imprisonment, and the effect of Section 3 seems to be to relieve a seller from punishment if the weight or bulk be not increased, which in principle is another curious conception.

The articles which have recently come under the notice of the analysts who are enforcing the Act are:—Mustard, cocoa, tea, coffee, sugar, pepper, milk, &c. The first—an article of large consumption, already severely handled by analysts—will suffice for our present notice

MUSTARD.—The knowledge of the virtues of mustard seed dates from a very early period. Its medicinal value is said first to have been discovered by the Greek physician Æsculapius. It was also known to the Jews, and to this day grows abundantly in Palestine as the *phytolacca dodecandra*. It is difficult to determine the date of its first use in this country, though probably at a very early period. Burton speaks of it having been used as a sauce in the twelfth century. Its dietetic use is of great benefit; it greatly assists the organs of digestion, excites the gastric juices of the stomach, and, acting as a tonic, promotes the appetite. The manufacture of mustard in its present form was commenced about the year 1720 by a Mrs. Clements, of Durham, who first conceived the idea of grinding the seed and dressing the flour; by her it was kept a secret for some years until she amassed a large fortune. Its first manufacture in London commenced in the year 1742, when a factory was built at Garlick Hill, City, now held by Messrs. Keen, Robinson, Belville, and Co., where a large and increasing trade is still carried on, which has caused "Keen's Mustard" to be known through all parts of the world—for which article, alone, they have received two gold medals. This firm is now making strenuous efforts to abolish the system of admixture to mustard of wheaten flour and other articles, which for a long time has been acknowledged by the trade. Out of six qualities of mustard manufactured by them four are guaranteed genuine. The admixtures to mustard need not necessarily be injurious to health. The component parts are, as recent analysis has proved, wheaten flour, pepper, and turmeric; but we see no reason why, as the flour possesses a virtue in itself—another article should be palmed off in its place to deceive the public. The demand for genuine mustard is daily increasing, and we are satisfied that if manufacturers will only encourage it, the public will buy no other. The prosecutions for the adulteration under this Act have been innumerable, and are now of daily occurrence, and we shall give them consideration hereafter.

Reviews.

NEW MODE OF ASSESSING DUTIES.

"Letter to the Right Hon. W. E. Gladstone on a New Method of Assessing the Duties imposed upon Maltsters, Brewers, and Distillers, founded upon the system adopted in Bavaria." London: Printed by Jas. Truscott & Son, Suffolk-lane, E.C.

THIS pamphlet has for its object the introduction to public notice of a new system for assessing the above-mentioned duties, which is an improvement upon the plan adopted in Bavaria, inasmuch as improved machinery is adopted, where it appears that in 1868 the Legislature passed a law that the brewer might crush his own malt at the brewery, and dispense with the attendance of the excise officer by using—affixed to his malt mill—a measuring machine, which measured the quantity crushed as it passed through the mill, and showed the number of bushels upon an index or counter similar to a gas meter index. The measuring machine and malt mill being enclosed in one case, and inaccessible except to the excise officer, the Government decreed that the indications of such index should be taken as the basis for the assessment of the malt duty. The measuring apparatus (the Bolzano-Riedlinger Patent) was specified in the Act of Parliament to be supplied by the company who owned the patent. The brewers of Bavaria are adopting the machine almost as fast as it can be supplied, and the duty of the excise officer will shortly be confined to visiting the breweries once in six weeks, taking the indications exhibited by the machine, and making out a charge thereupon, which has to be paid by the brewer within a certain number of days at the Revenue Office. This system in 1872 (since which year it has been more widely extended) saved the Government 600,000 florins, but when universally adopted, a net economy of 2,400,000 florins per annum will be realised. Although the plan is found to work most satisfactorily to all parties, the accuracy of this machine is not up to the standard required by the Government.

At this juncture, says the writer (Mr. Baxter), the managers of the company in Bavaria above referred to heard of my invention of an automatic *weighing* and measuring machine, which exactly supplied the deficiency of the apparatus sanctioned by the law, and after a searching investigation they attached to the invention a very high value. Looking to their experience in these matters, their opinions must necessarily be of more importance than any other person's; and, as a proof of their appreciation, they have undertaken to pay me a considerable sum in order to secure the exclusive license to manufacture and sell the machines in Bavaria, Austria, and Saxony.

My machine, which may indicate weight alone or weight and measure, is intended, therefore, to supersede the one now in use, which is simply a measuring machine. The advantages of founding the assessment upon the *weight* of the malt is confirmed in a curious manner by the action of some of the Belgian brewers, who petitioned their Government last year to impose a tax of 14 centimes per kilogramme upon the malt *or other grain* used by the brewers, in lieu of the existing system. Although the petition was not then granted, the ministers were entirely in its favour, and the promulgation of a law to enforce this plan is only delayed.

Having stated these facts, I will now explain my plan (known on the Continent as the *systeme Baxter*) for a "New and Improved Method of Assessing the Duties imposed upon Maltsters and Brewers":—

1. I propose to repeal the present Malt Duty and the Brewers' License Duty, and, in lieu thereof, to impose a duty of 11-14d. per lb. upon any grain, ground or crushed, for the purposes of brewing.
2. To render compulsory the use of Baxter's automatic weighing machine in all breweries and malthouses, affixed to the mills or rolls therein in such a manner that the malt or corn must pass through the weighing machine immediately before or after the grinding or crushing.
3. To regard every person a brewer who shall brew more than 10 quarters (or say 3,120 lbs.) of malt or raw grain per annum, whether the beer produced therefrom be for sale or for his own consumption.
4. To make it incumbent upon every maltster for sale to have a mill or rolls with weighing machine attached for the purpose of grinding or crushing malt for brewing when required, the indications of such machine being taken as charges and paid by the maltster, he having collected the same from the purchaser.
5. To determine that no maltster shall send out less than 10 quarters of malt unground or uncrushed.
6. To compel every maltster to keep a record, open to the Excise authorities, of the quantities sold and delivered by him, with the names of the persons to whom sold, dates of sale, and whether crushed or uncrushed.

An Act embodying the above rules would, I believe, sufficiently meet the case; and supposing the brewers urge that they are hardly used by being compelled to buy such a machine or machines, they must admit they have a *quid pro quo* in the shape of the removal of the restrictions upon malting and brewing, and payment of duty after use instead of before; in addition to which they would be at liberty to use any description of grain they might choose, malted or unmalted—a great privilege, and one of which the brewers of the beer-drinking countries of the Continent are availing themselves to a great extent.

I respectfully maintain that my system is of great advantage *to the Government* in effecting a considerable saving in the cost of assessment, *and to the brewer* in the removal of vexatious restrictions upon malting and brewing, and the payment of duty *after* the malt is used, instead of before, except in the case of the small private brewer.

As against its adoption there is only one point which can, I believe, be really urged, viz., that the dishonest brewer might get his malt crushed secretly, and might place it in the mash tun without passing through the machine, and that the large amount of the duty is a great temptation so to defraud the Government.

My reply to this objection is that the English brewer is not likely to be more dishonest than the Bavarian; but if he should be, the penalty under the present laws is so high that it would be sufficient to deter any man from risking discovery, and practically there would be immense difficulty in introducing ground corn into a brewery without the flour leaving some trace of its presence. Under the plan now in use for the assessment of the 6s. 3d. duty upon sugar consumed in breweries, the Government runs as much risk of fraud as it would under my system. I am inclined to think that the removal of all restrictions upon malting and brewing, and the deferred payment of duty, would be so highly appreciated by the maltsters and brewers, now that labour, fuel, and barley are rising in price, that they would feel much indebted to any Government which inaugurated the proposed system; and I am also persuaded that it will ultimately lead to a great saving in the Inland Revenue Department. The system allows of the use of unmalted grain, which would to a partial extent result from its adoption.

Of course it is equally applicable to assess the duty paid by distillers.

We consider Mr. Baxter's plan is entitled to the favourable consideration of the Government, though we cannot say that it would be quite right for the Government to absolutely confine the maltster or brewer compulsorily to use Baxter's machine, as that might eternally shut out other inventors; it might be made law that Baxter's machine must be used, unless at any future time some other machine, not being an infringement, should be especially allowed to be used by the Government. We regret that Mr. Baxter has given no details of his machine, and hope he will enable us to lay them before our readers.

THE POLAR WORLD.

"The Polar World: a Popular Description of Man and Nature in the Arctic and Antartic Regions of the Globe." By G. HARTWIG, M.R.P.D. Author of "The Sea and its Living Wonders," "The Subterranean World," &c. Second Edition, with light chromoxylographic plates, three maps, and numerous woodcuts. London: Longmans, Green, and Co. 1874.

UNINVITING as is the aspect of nature in the frozen regions of the North, yet to Englishmen these regions seem to possess charms that more favoured climes do not appear to have. Perhaps this may be owing to the fact that the countries in the high latitudes present to us society in its most primitive aspect, in which we make acquaintance with men who seem to be the brothers of our far-removed progenitors. Moreover, we, as it were, follow in the footsteps of navigators of the olden time, who sought to make what, ere the Suez Canal was dug, was expected to be, a short road for us to far Cathay.

Although this is a second edition, yet the work, being such as we have described it, we could not refrain from saying in its behalf, that, as regards this second edition, the author in the preface shows that the object of the work is to describe the Polar world in its principal natural features, to point out the influence of its long winter night and fleeting summer on the development of vegetable and animal existence; and, finally, to picture man waging the battle of life against the dreadful climate of the high latitudes of our globe, either as the inhabitant of their gloomy solitudes, or as the bold investigator of their mysteries.

The table of contents shows the great variety of interesting subjects embraced within a comparatively narrow compass, which Dr. Hartwig is quite justified in saying he has aimed at presenting in an entertaining form, and tracing the path of discovery to its most recent dates; but, he might have said with great truth, that he had fully succeeded in what he aimed at. At all events, we can say that much for his present production.

Dr. Hartwig fulfils his promise in several chapters, which respectively describe the General Character of Arctic Lands, their Quadrupeds and Birds; the Arctic Seas and Ancient Marine Animals; Iceland, the Icelanders, and the Westman Island; Spitsbergen Bear Island, as to which he states that:—Considering its high northern latitude of 75°, the climate of Bear Island is uncommonly mild. According to the reports of some Norwegian walrus hunters, who remained there from 1824 to 1826, the cold was so moderate during the first winter that until the middle of November the snow which fell in the night melted in the daytime. It rained at Christmas, and seventy walruses were killed during Christmas week by the light of the moon and that of the Aurora. Even in February the weather was so mild that the men were able to work in the open air under the same latitude as Melville Island, where mercury is a solid body during five months of the year. The cold did not become intense before March, and

attained its maximum in April, when the sea froze fast round the island, and the white bears appeared, which had been absent during the whole winter. The second winter was more severe than the first, but even then the sea remained open till the middle of November, evidently in consequence of the prevailing south-westerly winds. The greater part of Bear Island is a desolate plateau, raised about 100 or 200 feet above the sea. Along its western shores rises a group of three mountains, supposed to be about 200 feet high, and towards the south it terminates in a solitary hill, to which the first discoverers gave the appropriate name of Mount Misery. At the northern foot of this terrace-shaped elevation, the plateau is considerably depressed, and forms a kind of oasis, where grass (*Poa pratensis*), enlivened with violet cardamines and white polygonums, and saxifragas grows to half a yard in height. The general character of the small island is, however, a monotony of stone and morass, with here and there a patch of snow, while the coasts have been worn by the action of the waves into a variety of fantastic shapes, bordered in some parts by a flat narrow strand, the favourite resort of the walrus, and in others affording convenient breeding places to hosts of sea birds. In Coal Bay, four parallel seams of coal, about equidistant from each other, are visible on the vertical rock walls, but they are too thin to be of any practical use. Bear Island has no harbours, and is consequently a rather dangerous place to visit. During the first expedition sent out from Hammerfest, it happened that some of the men who had been landed were abandoned by their ship which was to have cruised along the coast, while they were hunting on the shore. But the current, the wind, and a dense fog so confused the ignorant captain that, leaving them to their fate, he at once returned to Hammerfest. When the men became aware of their dreadful situation they determined to leave the island in their boat, and taking with them a quantity of young walrus flesh, they luckily reached Northkyn after a voyage of eight days. It seems almost incredible that these same people immediately after revisited Bear Island in the same ship, and were again obliged to return to Norway in the same boat. The ship had anchored in the open bay of North Haven, and having taken in its cargo, consisting of 180 walruses, which had all been killed in a few days, was about to leave when a storm arose which cast it ashore, and broke it to pieces. The Russians had built some huts in the neighbourhood, and the provisions might probably have been saved, but rather than winter in the island the crew resolved to venture home again in the boat. This was so small that one-half of them were obliged to lie down on the bottom while the others rowed. The autumn was already far advanced, and they encountered so savage a storm that an English ship they fell in with at the North Cape vainly endeavoured to take them on board. After a ten days' voyage, however, they safely arrived at Margerö, thus proving the truth of the old saying that "Fortune favours the bold." The distance from Bear Island to North Cape is about sixty nautical miles.

Nova Zembla, Lapland and the Lapps, with notices of travellers such as Castrén, Wrangel, Steller, and others; Esquimaux and the Hudson's Bay Territories all receive due attention, and form the subject of much pleasant information. The Anarctic regions also come in for their share of attention, but these are not so attractive as the Arctic, and, therefore, do not occupy so much space.

After the insight we have afforded of its contents, our readers, we feel sure, will agree with us that this (like all Dr. Hartwig's works) affords pleasurable occupation in its reading, and at the same time conveys to the mind useful instruction of a scientific kind which adds to the store of truly useful knowledge.

ELEMENTARY CHEMISTRY.

"Elements of Chemistry, Theoretical and Practical." By William Allen Miller, M.D., LL.D., late Professor of Chemistry in King's College, London. Revised by Herbert McLeod, F.C.S., Professor of Experimental Science, Indian Civil Engineering College, Cooper's Hill. Part II. "Inorganic Chemistry." Fifth edition, with additions. London: Longman, Green, Reader, and Dyer. 1874

In our review of the first part of this standard work we took occasion to express our favourable opinion of it, and all we can say of the second part now under notice is simply confirmation of what we previously stated. For in this work, which we may fairly term one of the most important in our language, we find all the facts relating to the science of chemistry brought out in a way that we very rarely find in works professing to teach what this does, namely, the elements. It is a work which every student of chemistry, and others interested in the science should have always at hand. The process of revision, or rather editing, of this edition has, without doubt, fallen into very able hands, and the additions made are such as to bring the ever-progressing field of chemistry up to knowledge of the present day. In the preface the editor enumerates various alterations made in this edition of the work, considerable emendations being made in the order in which the non-metallic elements and their compounds are described with the view to facilitate the progress of the student in the theoretical part of the science by commencing with the elements, which form the least complex compounds, and gradually passing to those which form more numerous and complicated substances, and certain compounds of carbon and sections of gas analysis are, in consequence of their being allied more intimately with organic than with inorganic, therefore reserved for the third part, which will treat upon the organic branch of the science of chemistry. The editor takes occasion to express his thanks to Mr. C. E. Groves, F.C.S., for assistance received for valuable work done in seeing this part through the press when there was danger of its being completely stopped by illness; but we trust that that will not be the case with the forthcoming and last part of the work, which we hope to see shortly issued. In conclusion, we must repeat to everyone engaged or interested in the science of chemistry that they cannot do better than at once obtain this work.

GUN-CARRIAGES AND MECHANICAL WORKING OF HEAVY ORDNANCE.

By Mr. G. W. Rendel, M. Inst. C.E.

The following is the substance of the paper read at a recent meeting of the Institution of Civil Engineers, by the above gentleman:—Owing to the increase in the size and power of ordnance since the introduction of armour, gun-carriages had gradually become elaborate machines, and the appliances for working the monster ordnance now in contemplation would tax all the resources of mechanical science. The first difficulty experienced in mounting the Armstrong rifled guns arose from the much greater violence of their recoil as compared with that of the old cast-iron guns; a disadvantage mainly resulting from their superiority in lightness, strength for strength. A self-acting break for arresting recoil, designed and successfully tried at Elswick, in 1864, by the Ordnance Select Committee, on a 70-pounder timber carriage, was described. The great superiority of wrought iron to timber as a material for gun-carriages was next referred to, and experiments made in 1865 were cited, as showing the error of the popular objection entertained against wrought iron, on the score of its producing, when struck by shot, more numerous and destructive splinters than timber.

Some of the leading types of gun-carriages made at the Elswick works both for naval and for land service were then described, commencing with the plate compressor or recoil break, which was stated to have been adopted almost universally, and by nearly every power in the world.

The series included the 12-ton gun broadside carriage, also the 18-ton gun naval carriage and slide of similar construction, but capable of revolving about a rear pivot as well as a front one, so that the gun might be shifted from one part to another adjoining, and be used in both. The special feature of the plan was the pivoting of a portion of the rack, by which means it could be made available for training the gun in both ports.

This rendered unnecessary the turn-table now used for the same purpose, which was held to be objectionable in a ship, for a large hole had to be made in the deck, the deck beams must be cut and space occupied below, besides which a serious and costly complication in the structure of the vessel was introduced.

In the 15-ton gun wrought-iron carriage and slide for land service, attention was directed to the method of training the platform, and to the substitution for the usual tripping rollers under the carriage of a number of grooved rollers, permanently running on the slide. The training was effected by gear connecting the platform trucks on the front and rear rails in such a way as to drive them at a speed proportioned to the respective radii of the rails. The result was that the platform moved truly about the centre of both rail circles, required no actual pivot, and was trained with ease and rapidity by the simple traction of the wheels. By placing the carriage permanently on wheels, and trusting more to the compressor to arrest recoil, the operation of "tripping" the carriage, *i.e.*, of throwing the wheels into action for running out, was avoided, thus saving time, labour and exposure of men.

By the adoption of mechanical arrangements, for the application of manual power to the working of ordnance, guns up to 25 tons weight could now be worked with more ease, safety and rapidity than guns of a fifth of that weight were formerly. The size of ordnance continued, however, to increase by rapid strides. There were already many rifled guns in existence of 36 tons or 38 tons weight, throwing 700 lbs. shot. Guns of nearly double that weight were actually being made, and there was no manufacturing obstacle to the construction of still larger guns. It was difficult, indeed, to place a limit to the size of gun that could be produced on a system, like that of Sir William Armstrong, under which the gun was built up of concentric cylinders superposed in layers, whose number might be increased so as to form an immense total thickness, without involving any one piece of unmanageable dimensions. The powder pressure attained with large charges would, possibly, first impose a limit on the size of guns; but recent experiments and investigations gave ground for the belief, that even with charges vastly exceeding any yet used, the powder pressure might be regulated and kept within prescribed bounds. Hence, then, the adoption of some inanimate power, in the place of mere hand labour, for loading and working heavy ordnance, desirable as it was for existing guns, became an absolute necessity for guns of the immediate future. The simplicity and compactness of hydraulic machinery, and the perfect control it gave over heavy weights, especially adapted it for the purpose. Hydraulic power sufficient for the heaviest gun might be transmitted through a very small pipe, for long distances and by intricate ways; so that a steam pumping engine might be placed in a fort or ship in such a position as to be absolutely secure, and supply power, by this means, for working many guns. A detailed description was

then given of some of the arrangements experimented with, or now in progress, for loading and working guns by hydraulic machinery. These arrangements embraced a new system of mounting turret guns, in which the carriage was dispensed with, and the gun was supported on three points, viz.: on a pair of trunnions placed well forward and on a saddle under the breech itself. The trunnion arms rested in two sliding blocks, which ran in guides on fixed beams, built on the floor of the turret. Immediately behind each block in the direct line of recoil were two hydraulic cylinders for checking recoil and running the gun in or out. The saddle which supported the breech slid along a beam or table beneath it. The front of the beam could be raised or lowered by a hydraulic press to give any desired elevation, but the rear was pivoted at a point corresponding to the horizontal position of the gun; consequently the gun returned always to the horizontal position as it recoiled, whatever elevation it might be fired with, and cleared the port in coming back. Thus the advantage of muzzle pivoting, viz.: the reduction of the size of port-hole, was to a large extent realized without the necessity of lifting and lowering the gun itself.

In the system of mechanical loading for guns mounted in turrets, the gun was revolved and brought to a fixed loading position, where it was sponged and the charge rammed home by hydraulic power. The shot was brought up to the loading place on a small railway truck, controlled by a friction plate, which clamped it to the rails whenever the truck handle was lowered. It was then run on to a hoist, which rose between guides against stops, and brought the shot opposite the gun muzzle ready for being rammed home by the hydraulic rammer, consisting of a parallel tube in which ran a piston and tubular piston-rod. The head of the rammer formed a sponge for cleansing the bore, and contained a self-acting valve which opened when pushed against the end of the bore and discharged a strong jet of water within the gun. A jointed rammer, used for positions where there was not sufficient space for the tubular rammer, was also described. The advantages attained by this arrangement were as follow: The loading operation was transferred from a confined space and exposed position in the port of the turret to a roomy and convenient place on the main deck, where the apparatus was completely protected; the dimensions of the turret were greatly reduced; one man in the turret and one outside might direct and control all the movements of a pair of the heaviest guns, and might load and fire them without other help than that involved in bringing up the ammunition; and, finally, far greater rapidity of fire was attainable than would be possible by manual power. With reference to the necessity the system involved of turning the turret round always to one of two or three fixed loading positions, it was stated that the turrets of the *Devastation* made a full turn in forty-five seconds, and that a railway swing bridge over the Ouse, constructed under the direction of Mr. Harrison, Pres. Inst. C.E., and weighing 800 tons, was turned with almost equal facility by means of hydraulic machinery. It was also stated, as a matter of fact, that the whole operation of bringing to loading position, sponging, loading, and placing again in firing position a 9-inch 250-pounder turret gun, mounted experimentally on this plan, had been effected in twenty-three seconds. The jointed rammer had been successfully applied on a garrison platform. In this case, as the rammer was fixed on the platform, there was no necessity for turning the gun to a definite loading position, and the loading gear and men working it were protected by the parapet. By the present method of loading barbette guns by hand, the men had to mount upon the platform in full view of an enemy, and besides being exposed to shell fire, they became the targets for a rifle fire, which, owing to the precision and range now attained with rifles, would render it difficult to keep guns in effective action under such circumstances.

In suggesting another plan for the application of a hydraulic system of loading in casemates, it was stated that there was no doubt more difficulty in the adoption of mechanical loading in existing casemate forts than in turrets, or open earthworks. The size of artillery had so outgrown that of the existing forts, during the long time necessarily expended in their construction, that 38 ton guns had now to be mounted, if possible, in batteries originally intended for 12½-ton guns. But this fact made it only more imperative to dispense with manual power, because the larger guns, while they further restricted the already limited space, required larger crews. The service by large numbers of men of heavy guns closely ranged in confined casemates, tier upon tier, might lead to serious confusion in the heat of action; and the necessity of crowding men in time of war in isolated forts was of itself a grave evil. By substituting hydraulic for manual power for working the guns, nine-tenths of the men might be dispensed with, and the work might be done more coolly, rapidly, and efficiently. Rapidity of fire was nowhere of greater importance than in the case of guns designed to prevent the passage of swift steamers past fixed batteries; and economy of men was a vital consideration in the defence of a coast so extended as that of the United Kingdom. It was said that already far more guns were mounted than could be manned. Modern artillery could only be worked with highly trained men, whom it would be impossible to produce upon short notice. Nor could the present small force be made effective by activity in shifting men to threatened points, for the attacks of steam fleets would be sudden and unexpected, and could only be met by preparation at all points.

The introduction of an effective system of mechanical loading had an important bearing on the question of the comparative merits of breech and muzzle loading, because it enabled a gun, however long in the bore, to be loaded at the muzzle with at least as great facility as at the breech, while dispensing with the complications of breech mechanism and the time required to work it, both of which became important considerations in the case of monster ordnance.

The principle of sinking guns entirely under cover from horizontal fire behind any sufficient parapet, and raising them only to deliver their fire, possessed the great advantage of making earthwork defences available. All defences must yield to continued attack; and an iron fort when seriously injured could scarcely be made good before the end of a war, and only then at great cost. It was the especial merit of earthwork, that it might be easily strengthened and adapted to new circumstances, and that it might be repaired almost as fast as it was destroyed. In the two forms of gun-carriage, adapted for this system of protection, which had been proposed by Major Moncrieff, the principle was the storing and utilising of recoil in the one case by the raising of a weight, in the other by the compression of air. The economical value of the utilization of recoil was insignificant where steam power was available. The main object to be attained by the utilization of recoil was to make of each gun-carriage a machine complete in itself, and independent of any connection with other machinery for producing the required power. In a system, however, of hydraulic gun-carriages, supplied with power from steam pumps, the connection between the carriage and the source of power was of the simplest kind, consisting only of a small pipe, which might be furnished with a stop valve, and thus enable the power to be turned on or off, with nearly as much facility as a jet of gas. As there was no limit to the amount of power that might be conveyed, so there was no restriction of the height of cover obtainable—an important point in the employment of earthwork as a protection for guns, since the crest of the parapet might easily be cut down by the enemy's fire. A drawing was exhibited of a 12½-ton gun mounted under cover of earthwork so as to be raised to the firing position by hydraulic power, and the advantage of using a power independent of recoil for raising the gun was illustrated by the height of cover obtained. A working model was also exhibited of a 38-ton gun similarly mounted, as designed for the upper deck barbette battery of H.M.S. *Téméraire*—a vessel which, being intended for ocean cruising, and provided in consequence with masts and sails, required a high deck and could not carry a revolving turret.

The Paper was elaborately illustrated by diagrams, and, in addition, by working models of hydraulic mechanism.

CONFERENCE ON THE PATENT LAWS.

At the meeting of the Inventors' Institute, March 10th, 1874, Sir A. Brady, Chairman of the Council, presiding, the Chairman, after stating in general terms what were the objects of the meeting, observed that in this country few domestic questions were of greater importance than the improvements of the Patent Laws, and it is with the view to take steps to induce the Government to adopt efficient measures of amendment that the meeting was held that evening to consider what the Institute was to do in the matter. Recently he had been one of a deputation that waited on the late Lord Chancellor (Lord Selborne) to lay before him the abominable state in which the so-called Patent Museum at South Kensington was kept, who when the matter was placed before him was so struck with what he and others had brought under his notice, that he said he would rid himself of the responsibility on his shoulders as quickly as possible. The same objectionable character applied to the law of patents in this country, and he considered there was no doubt whatever that the law ought at once to be put upon a satisfactory footing; and any man, if he went thoroughly into the question, would agree with him that the time had arrived when the Government should take the matter up. At this moment a patent is granted provided you pay the fees, and there is no real inquiry into the question whether a patent had been granted before for the same invention; for, so long as you are ready with the cash, you have your patent. And, supposing the patent is infringed, you are left to fight it out without even a *prima facie* presumption of validity, so that in fact a patent means simply a right to go to law, and an invitation to all men to drag you into lawsuits. Now, the great point should be to render every facility for getting a patent where there is any just claim to one, therefore the first thing should be a reduction of the fees; and, further, all patents should be indefeasible. Also, a patent should not be granted a second time for the same thing, as under the present state of the law is repeatedly done; hence preliminary examination is necessary. The time was fully come when this subject should be taken up in earnest, and that something should be done in order, if possible, to get a Bill into Parliament during the present session. The subject is one interesting all, and especially was it of importance to the working man. In fact, he thought it essentially a working man's question. He would be glad to have the full and free expression of the opinion of the meeting on the question.

The Secretary then read various letters from the members who were unable to be present, and in each case it was stated great improvements in the

law were necessary, especially in regard to reducing cost of patents, and, after reading the correspondence, Mr. Campin (the Secretary) took occasion to refer to the action that had been taken by the Council of the Institute in reference to the Patent Laws, alluding to the Inventors' Right Bill, and also to the report of the Committee of the Institute in reference to the House of Commons report. (See SCIENTIFIC AND LITERARY REVIEW, January and Feburary, 1874.)

Mr. PATERSON said that he quite agreed that there should be a reform in the law, and that the reforms advocated by the Institute should be carried out. One great reform, he thought, should be in the mode of printing and publishing the specifications, and also, as a very great essential, there should be a complete assortment of abridgements, so that a man, if he wishes to patent an invention, may first of all, before spending his money, be able to find out whether his invention is new, for, he was sure, under the present system, it was utterly impossible for anyone to search with the hope of finding out anything of the sort. Now, in regard to this, he considered the system adopted in America should be also adopted here, for there you have all that is required in regard to these essentials, and besides in that country they have a most magnificent museum arranged in good order so that an inventor may see whether his invention is new or not. A very great difficulty in the way of every poor inventor now was, that the fees were too high for him to think of his getting the benefit of his brains, and he therefore thought that a considerable reduction was necessary in order to make the law as applicable for the poor man as for the man that has capital, and, further, that instead of paying down the lump sums at the end of the third and seventh years, an annual tax, commencing at the end of five years, might be adopted. He thought that the time for action had now arrived, and that an appeal should at once be made to the Government, with the view of getting some alteration during the present session of Parliament.

CAPTAIN SELWYN observed that he had taken great interest in the questions relating to Patent Law, and, amongst other things, he held that patents should be indefeasible, and he also held that property in invention was as much a necessary part of true law and order as all other property. He considered that a man, without the means of paying the exorbitant fees now charged, should be placed on the same footing as a man with capital who would not scruple to rob the poor man of his invention. This country, as regards invention, presents a remarkable contrast to America, where an inventor is taken by the hand to be led to success; whilst the fashion here in England is that he is taken by the throat and robbed, for if, perchance, the man with capital takes an inventor by the hand, and says "I will get you a patent;" when he has got hold of the invention he is, in this country, free to take it, and thereby rob the real inventor. Where inventors are encouraged, as in America, patents are increasing at a great rate, the number granted being over three times that in England, and also in America by reason of its passing through the hands of the examiners, you may reckon on the novelty of the invention. That is not the case here where you take patents at your own risk and chance if they have not been patented before. As regards what had been proposed by some persons, namely, to give state rewards, he thought that the system as at present practised was bad, seeing that within the last few years large rewards for inventions had been awarded, and that money had in some instances been thrown away by reason of the inventions having been superseded or declined in value. Under a proper system and conditions, state rewards should be given to inventors. The mode of obtaining a patent required great revision, for the law should be such that a poor man might, for a nominal sum, have a patent, on his proving his invention to be new, which could be done by adopting something like the American system. A patent once obtained, it should be indefeasible; and, therefore, he was for patents being cheap and indefeasible. In dealing with this subject it behoves statesmen not to forget that in these days of competition foreign nations are running us hard in the race, and, therefore, the importance of this question is very great to this country, where the national prosperity rests so greatly upon industrial progress, which means nothing more nor less than the progress of invention.

Mr. MACOMBER, after reverting to the remarks of Captain Selwyn, with whom he entirely agreed, proceeded to show by statistics the great encouragement offered to inventors in America, where a moderate fee is charged for the patent, and where a patented invention may generally be relied upon as being novel, for if not the patent is almost certain of being refused by the examiners. The patents applied for in 1872 were 19,587, and those passed by the examiners were 13,626, so that rejections for want of novelty and such like questions, numbers no less than 5,961. After further remarks on the superiority of the American over the English law, he stated that he was of opinion that a considerable reduction was necessary in obtaining a patent in this country.

Dr. HASELTINE concurred with Mr. Macomber.

Mr. NETTLEFOLD observed that he thought inventors were too much taxed, and that the expenses in getting a patent should be small, and, also instead of the lump sums having to be paid, as now, a small annual tax should be substituted.

Mr. EVAN LEIGH said he thought they were all agreed that patents ought to be rendered cheaper in the first instance, so that a poor man may be able to get a patent as well as the rich man, and that some such system should be adopted as in America, that no patent be granted but to the real inventor. No tax should be imposed for, say, the first five years, but, after that, an annual tax might be imposed.

Mr. G. SAVAGE, speaking from a working man's point of view, said he considered that this was a question in which they were deeply interested, and he was certain that they were entirely in unison with the propositions advanced by the Institute. In the first instance, it was essential that the law should be brought within the sphere of a working man, and this could only be accomplished by making patents cheap in the outset. It must be a matter of shillings, not of pounds, so that a working man might reap the benefit of his brains. At present a working man was entirely out of the question in getting a patent, the high fees barring him; being made, he would suppose, for the purpose of feeding hungry lawyers. He had had a great deal to do with this question, for he had been connected with exhibitions in which the inventions of *bona fide* working men had been exhibited, and he could say that, as a rule, in very rare instances have they reaped the benefit of their inventions. Mr. Savage gave his experience as regards the working of the law at present, and concluded by saying that he thought strong representations should at once be made to the Government with the view of having the law amended, and he felt convinced that they would have a fairer hearing from the present Government than from the late one.

Mr. [illegible] HOLTEN agreed generally to what had been put forward that evening, and that the law ought to be amended. He agreed that something like the American law ought to be adopted, but there was one thing he could not agree with, that a model should be compulsory, as some models cannot be made under a considerable sum. He was in favour of patents being indefeasible.

Mr. MACOMBER asked what was the amount of surplus taxes on patents in this country?

Sir A. BRADY observed that the sum was about £80,000 a year, and that the whole amount was something over a million of money.

Captain SELWYN, in consequence of an observation by a member, stated that he advocated compulsory licences only, where it was found that the owner of a patent could not meet the public demand.

Mr. A. J. MURRAY observed that he always had been opposed to compulsory licences, but where it was found that the patentee did not meet the demand of the public, then, he thought, under certain restrictions the suggestion of Captain Selwyn ought to be adopted, and in this view of the case Mr. Leigh also concurred.

Mr. VARLEY proposed a vote of thanks to the Chairman, to whom he said the Institute was much indebted for forwarding the great work they had advocated that night, in the way he had done in connection with this Institute for some years past. He would also take this opportunity of expressing his feelings with regard to the services rendered to the Institute by Captain Selwyn, in the prosperity of which he had taken an active part for so many years. He was quite sure that the meeting would pass the vote of thanks to the Chairman with acclamation.

Mr. CAMPIN, in seconding the resolution, remarked that as Secretary, he was in a position to know how much the Institute had been advantaged by the services rendered by Capt. Selwyn and the Chairman.

The vote of thanks having been passed, Sir A. Brady briefly responded, and the meeting closed.

PATENT BARREL HEAD.

An ingenious device for enabling barrel heads to be readily removed and repaired, without taking off the hoops, is described in a recent issue of the *Scientific American*. The head is made in three parts, 1, 2, 3, the jointed edges of which are beveled off (sections 1 and 3 on the top side and section 2 on the lower side) so as to form a solid head both as to inward and outward pressure, when a metallic plate is properly affixed. The middle section 2, is of V shape, and its wide end enters the croze or grove, while the point reaches near to the opposite side of the barrel, and is held in place by a plate, which is secured by screws to sections 1 and 3. To remove the head from the barrel, one of the screws is withdrawn and the plate turned on the other screw until it clears section 2, when the latter is easily removed by the thumb and finger inserted in notches near the end. To place the head in the barrel, the above operation is simply reversed. Patented by Mr. Alexander Hanvey, of Steubenville, Ohio.

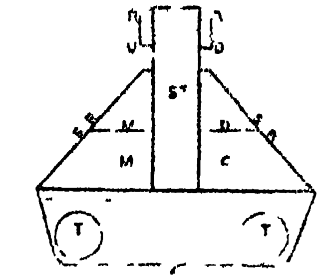
FIRE SUPPRESSION.—In our report of Mr. P. A. Blake's paper on this subject, read at the Inventors' Institute members' meeting, on Feb. 19th, there is a typographical error, which makes the cost of applying Mr. Blake's invention to be £5; it should be *five shillings*.

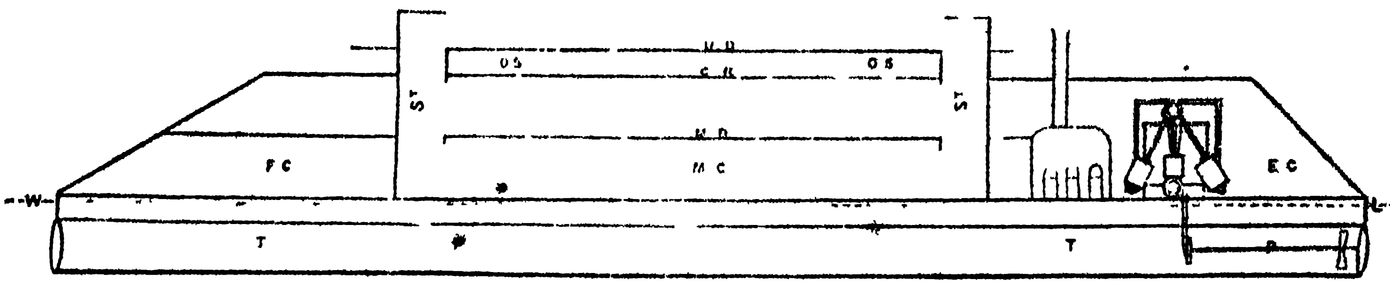
Messrs. Chatto and Windus, publishers, Piccadilly, W., announce the publication of "The Cyclopædia of Costume; or, a Dictionary of Dress, Regal, Ecclesiastical, Civil, and Military," from the earliest period in England to the reign of George the Third, including notices of contemporaneous fashions on the Continent; and preceded by a general history of the Costumes of the principal countries of Europe, by J. R. Planché, F.S.A., Somerset Herald.

Messrs. Dean and Son announce for publication immediately after the assembling of Parliament, "Debrett's House of Commons, and the Judicial Bench," which will be edited by Robert H. Mair, LL.D.

ANTI-WAVE SHIPS.

By Dr. W. S. Carmichael.





The following is the substance of a paper by the above-named gentleman to be read and discussed at an early meeting of the Inventors' Institute —

Gentlemen,—I am happy to have this opportunity of bringing my invention before a body of scientific men, able and willing, I doubt not, to estimate scientifically the proposed innovations, unbiassed by the influence of time-honoured usages.

My invention is intended to modify the influence of the waves, &c, by covering certain generally exposed parts of vessels, and thereby to lessen the dangers and inconveniences of the sea. It consists of one general principle, viz, the defence of certain generally exposed parts of vessels by a covering.

1st. The defence of the sides and decks by sloping roofs, thereby enabling the vessel to retain a more horizontal position, and abating the dangers and inconveniences of the sea.

2nd. The defence of the screw or screws by a covering, thereby saving it or them from shot, &c, and enabling it or them to act with more effect.

It consists of a hull up to the water level, W L, somewhat like that of other vessels, except that the keel is straight and horizontal, the bow perpendicular, and it is perforated by one or more openings to be afterwards described. I propose that the vessel shall be nearly flat-bottomed, the sides below the water level nearly perpendicular, and also that the heaviest parts shall be on the outside.

Near the water line, W L, or several feet above it, according to the size of the vessel, the sides all round slope inwards, become a sloping roof S R over the cabins, M C, F C, E C, and main deck, M D, &c., at an angle of 45°, more or less, forming a breakwater on which the waves in rough weather may harmlessly expend their force, instead of dashing against nearly perpendicular sides, or washing the deck. These sloping roofs at the front of the vessel meet and form a sharp ridge, by which a wave at the front is cut in two.

The upper part of this sloping roof S R may be made mostly of sliding panels, which may be pushed aside in calm weather, so as to render the main deck, M D at such times nearly as open as in other vessels. Of course in the harbour these panels will always be drawn aside, so as to leave room for the entrance and exit of passengers, &c., the carriage of luggage and cargo, &c.

Seven feet, more or less, above the main deck, M D, the sloping roofs end in a flat roof, G R, to allow the more violent waves to pass harmlessly from windward to leeward; and, by being partly glazed, to give light to the decks below. The cabins below may also be lighted by the usual bull's-eyes.

Three or four feet, more or less, above the partly glazed roof, there is a smaller upper deck, U D, about half or a third of the size of the main deck, for captain, pilot, &c., and from which the vessel may be steered. This is supported on iron rods, braces, &c, not represented in the illustrations, and also by having a round enclosed staircase, St, at each end, leading down to the decks and cabins below. I think this upper deck should be surrounded merely by a light railing, R, so as not to catch the wind.

The moving power is generally one or two propellers, P, within, or immediately behind, one or two tubes, T T two to eight feet in diameter, more or less, extending from stem to stern. If, on account of friction or other cause, these long tubes be found inexpedient, I propose two shorter tubes near the stern, either passing through part of the vessel, or altogether on the outside; or, finally, one tube from the stern with a branch passing through each side.

By such means I expect that in calm weather such a vessel will advance through the water pretty much like other vessels, perhaps a little faster. That in rough weather the waves will rush harmlessly up the sloping roof and through the open space, O S, to leeward, and that the windward side of the vessel will not be so inconveniently raised, both on account of the heaviest parts being on the outside, and on account of the shock of the waves being received on a sloping roof, which will cause that part to be depressed rather than raised, and my object is so to balance these forces, by varying the angle of the slope if necessary, as to keep the vessel steady.

I expect, also, that the bow, by modifying the slope if necessary, will advance straight through a wave, instead of rising over it, and thus that the vessel will remain much more steady than is usual, and, as there will be less pitching, rolling, &c., that foundering and sea-sickness, and other dangers and inconveniences will be less likely to occur, and as its course will be shorter, passing through instead of over the waves, that it will also be more rapid.

An open space for the waves to pass through, and a high deck beyond their reach, is an old idea of mine, revived by the late discussions about the means for preventing sea-sickness.

I expect, also, that as the water reaches the screw more directly, this will have more power; that the loss of power from slipping will not be so great; and that the screw will act more as if it were rotating in an unyielding substance, or pumping the water from stem to stern.

The screw will also be less exposed to danger from ropes, chains, torpedoes, shot, &c.

This is also an old idea of mine, revived by some late newspaper notices about the danger to which the screw, especially in war vessels, is exposed.

When the wind is favourable, water sails may be used, or other sails with jury masts.

I think that flat-bottomed boats built on this plan might be useful for landing passengers through a surf as at Madras, and a modification of it for life-boats. In these cases a screw driven by a small steam engine or strong arms would be necessary. Such a plan might enable fishermen to bring themselves and cargo home in safety, instead of losing both by being swamped in a sudden storm. Such a plan in sailing vessels might save sailors and deck cargo from being washed overboard, as sometimes happens, and the vessel itself from foundering. In this case a high deck would be necessary, either on the top of the sloping roof, or made by connecting the fore, main, and mizen tops, or by both plans.

When I explained my invention to a friend of mine here, he said to me derisively, "Would you have your vessel lie on the surface of the water like a log of wood?" He expressed my intention almost exactly. I would have my vessel, in rough weather, lie on the water, or rather advance through it, like a log of wood sharpened at the front, the water washing every exposed part of it except the high upper deck. Taking this view of it, there seems to me some similarity between it and the catamaran of Madras; this is merely three logs lashed together, upon it one, two, or three men kneel, and paddle through the surf when no other craft can venture. In this case the catamaran and the legs of the natives washed by the waves may represent the body of my vessel and its roofs; the heads, bodies, and arms of the natives may represent my upper deck and its occupants.

Another objection is that a violent storm would soon wash away all my sloping roof. This is easily answered; the first six, eight, or ten feet above the water line must be made as strong as the bulwarks, or rather the sides of other vessels. Beyond eight or ten feet the force of the waves is not against the sloping roof, except the mere weight of the water, but obliquely upwards at the angle of the slope, and I would have the movable panels only about six, eight or ten feet above the water level.

The engraving is meant to represent a transverse vertical section through the after staircase St, and a longitudinal vertical centric section, both about 1-300th of real size, one inch representing about 25 feet.

T T, tube or tubes for propeller or propellers; W L, water level; M C, F C, E C, main, fore, and engineers cabins; M D, main deck; S R, S R, sloping roofs, the bow and stern sloping roofs not lettered; G R, flat roof, partly glazed; O S, O S, open space for waves to pass through below upper deck; U D, upper deck; R R, railings round upper deck.

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Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES.—SESSION 1873-4.

Attendance of Members and their Friends is requested on—

THURSDAY, April 2nd.—Patent Law Conference.

THURSDAY, April 16th.—On "Construction of Iron War-ships and Fort-faces." By R. BELL, Esq., C.E., F.R.I.B.A.

THURSDAY, April 30th.—On "Improved Cooking and Heating Apparatus for Peat and other Fuel, with Suggestions for Food Reform." By Mrs. A. LEWIS.

Meetings commence at 8 p.m.

TO MEMBERS OF COUNCIL.

Council meetings to take place at 7 p.m. on same evenings.

Subscriptions are payable to Mr. G. A. STREETON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

At the meeting of Council (ordinary) held March 5th, 1874, W. Yates, Esq., in the chair, the minutes of the last meeting having been read and confirmed as correctly entered, the Secretary reported that Mr. Jonathan Newall requested the opinion of the Council on his invention, of which he had forwarded a descriptive statement. This being read, it was referred to Mr. F. H. Varley and the Secretary to act as a sub-committee to examine into the matter, and report to the Council.

It was resolved that at the next Council meeting the first business should be the course to be taken by the Council with regard to Patent Law Amendment, and that the Secretary should in the meantime call the attention of all the members to the present state of the patent question. (This has been done by the notice to members of the Institute, which appears in another column, being sent to each member.)

Members recorded—Messrs. W. E. Debenham, Dillwyn Smith, King, Roman, M. Samuel, Fear, W. H. Davies, A. M. Silber, A. Heatherington.

At the meeting of Council (ordinary and special) held on 19th March, Sir Antonio Brady, the Chairman of Council, presiding, after the reading and confirmation of correctness of minutes, it was resolved that, in order to place the Institute in a better position to carry on efficient action with regard to Patent Law Reform, it seemed desirable to make some changes in the rules. A committee was, therefore, appointed to consider what, if any, alterations could be beneficially made in the rules and proceedings of the Institute.

The accounts of the Institute were also ordered to form the subject of special business at the next meeting of the Council.

Members recorded—Messrs. W. L. Anderson, Jas. Webster, M.E., Geo. A. Tenion, John C. Peacock, J. B. Orr, T. Sheeham, J. Harvey, G. Coates.

At the members' meeting held on 5th March, 1874, Mr. F. Varley (Chairman of ordinary Council or Executive) presiding, Mr. T. Yates read his paper "On Raising Sunken Ships," and this, with discussion thereon, will be hereafter reported.

At the members' meeting on 19th March, Sir Antonio Brady (Chairman of the Council) presided; as the conference on the Patent Laws and the report of the proceedings thereat will be found in another column.

Monthly Notices.

H.M.S. Challenger is stated to have arrived at Melbourne. She has visited Kerguelen Land and Heard, or MacDonald, Island, and attained a latitude of nearly 66½° south. By the next mail we may expect, says the *Athenæum*, some interesting details of this part of her scientific voyage.

Absorption of Ammonia by Plants.—At the meeting of German men of Science at Wiesbaden, amongst others, M. A. Mayer gave an account of his experiments to determine the power possessed by plants to absorb ammonia *above* the surface of the ground, the general result being that the healthful growth of the plant was interfered with if the introduction of ammonia by the roots was prevented.

Decolorising the Diamond.—At the same meeting M. Flight described some curious experiments on the influence of heat and light on the colour of the diamond. Diamonds of a yellow colour, from the Vaal river, lost their colour when heated to redness in a current of hydrogen, and remained colourless when cold in the dark. If exposed to light they gradually recovered their colour.

Indian Coal.—Mr. F. R. Mallett, of the Geological Survey of India, is reported to have discovered coal of good quality near the Darjeeling hills. The seams are said to be of considerable thickness.

Dr. Arnott, well-known in connection with the invention of the Arnott's Stove and Ventilator and the Water Bed, died on the 2nd March.

Photographs of Interference and Difraction Phenomena, obtained by receiving the shadows, &c., on prepared plates instead of on an ordinary screen, and then projected on the screen of the lecture-room by means of a lime light, have been exhibited by Professor Clifton, in illustration of his lectures at the Clarendon Library, Oxford. The impression on the sensitive plate was sometimes magnified to 2,500 diameters. The Professor considers that similar photographs had not before been made available for lecture-room purposes.

Poggendorff Jubilee.—A special Jubilee Volume, dedicated to Johann Christian Poggendorff, is about to be issued by the editor's friends, in recognition of his long-continued services to scientific literature, the famous *Annalen der Physik und Chemie* having now been in existence just 50 years.

The Monthly records of Results of Observations in Meteorology, Terrestrial Magnetism, &c., taken at Melbourne Observatory during July and August, 1873, are to hand.

We regret to hear of the death of Dr. Forbes Winslow, the author of many works on lunacy, and for many years editor of the *Quarterly Journal of Psychological Medicine.*

Laws and Courts of the United States.—Of remarkable interest to the curious reader, as well as of great use and value to lawyers, notaries, commissioners, collecting agents, and business men, on both sides of the Atlantic, is a new volume, edited by Mr. Horace Andrews, A.M., of the New York Bar, and published by Andrews, Gibson, and Bateman, in the same city, their London representatives being Messrs. Stevens and Haynes. This "Manual of the Laws and Courts of the United States, and of the several States and Territories, with a directory of reliable Practising Lawyers," is a practicable tribute to the recent rapid extension of business relations between England and America. Ignorance of peculiar local statues has hitherto been the stumbling block to safe legal contracts made in this country with respect to any district of the United States.

Late High Tide in the Thames.—With reference to the late high tide, Mr. R. Taylor proposed at a recent meeting of the Metropolitan Board of Works, that the Chief Engineer should report upon the possibility of preventing the overflow of the Thames in future. Mr. Runtz believed the only way to meet the evil would be to extend the southern embankment lower down the river. Ultimately the Chief Engineer was directed to consider the subject and report to the Works and General Purposes Committee.

New Work on the Moon, by James Nasmyth, C.E., and James Carpenter, F.R.A.S., in which the Moon is considered as a Planet, a World, and a Satellite, with twenty-four illustrative plates of lunar objects, phenomena, and scenery, and numerous woodcuts, has just been published by Mr. Murray. As the space at our disposal in this number does no permit us to give such a review of this excellent work as it deserves we are reluctantly compelled to reserve it for a future opportunity. We may, however, remark that the work is one that should be in the hands of all who take an interest in Astronomy and Science in general.

THE CONDITIONS OF MENTAL ENERGY AND MENTAL INTERCOMMUNICATIONS

By Delta.

A thought or will is conceived in the brain, how it matters not here, and is propagated to the external world chiefly in five ways

Those are—

1st By means of the voice, a mechanical disturbance of the atmosphere, whose waves break on the tympanum of the ear, and the impressions formed by the shock of these atmospheric billows, are transmitted by the auditory nerves to the brain

2nd. By manifestation of power in the arm and hand imprinting certain marks or characters on paper which are presented to the retina on which they are reproduced, and thence conveyed by the optic nerve to the brain

3rd. By a similar process, but the interposition of an electric

4th. By gestures communicating themselves to the brain as in the 2nd and 3rd cases.

5th By exchange of expression between the eyes

Of these five methods, the first three are alone adopted to the interchange of complicated ideas, but in each there exists a certain interval of greater or less duration when the thought consists solely of a mechanical motion either of the atmosphere or according as it finally presents itself to the auditory or the optic nerves

Let me be more explicit. There exists during a certain infinitely small period of time a condition of molecular disturbance solely, and during this interval it is conceivable that there are limits in space between which the molecular disturbance is occurring limits which isolate it in space

For simplicity, let us take the case of a gun fired at a distance The flash is seen, and in the immediate neighbourhood of the discharge the report is synchronous almost with the flash. But at a considerable distance this is not the case. The sound of the explosion does not strike a distant ear for some seconds, even minutes, after the occurrence of the phenomenon it announces It is contrary to the known laws of the propagation of sound in elastic media that the whole of the intervening space should exist in a state of molecular disturbance at the same instant, time being necessary for the transference from atom to atom or molecule to molecule of the motion

The bounding surfaces progress in space and it is not necessary that these should even travel at the same rate The volume of matter throughout which the disturbance occurs may be continually increasing, but the velocity of the atomic or molecular motion is decreased.

The total *vis viva* remains constant, and the isolation of the disturbance is complete

We are apt to hear the expression "as quick as thought," but this can alone refer, strictly speaking, to the conception of the thought, its propagation being entirely dependent for rapidity on the medium whose atoms transmit it

Thus thought, in its transmission from one mind to another, is subject to the same laws of rapidity of transmission and depreciation under the law of inverse squares as any other attribute of the material universe.

It may be true that the same thought flashes across two minds apart occasionally at the same instant, but as it is the result, I think we may conclude, of some influences exterior to both minds, it cannot afford the basis of an argument for the absolute instantaneity of the transmission of thought.

So far then, perhaps, we may conclude that we have cleared our way, and admit the proposition that thought during its transmission from one mind to another consists of a mechanical motion of the atoms or molecules of the medium in which it is propagated, and is subject to the laws of that medium whether it be the ether pervading space the atmosphere, or a telegraph wire

This subject as we advance is one whose difficulties continually increase, we are dealing with a subject on the very confines of the knowable, and have no experimental lights to guide us through the almost untrodden paths we would follow, and the difficulties which surround us magnify themselves in the dim twilight, yet we have accomplished something towards a point where, with the bright daylight of experiment to help us, we may tread with surer steps

We have done something, I think, in opening up a field for contemplation, shadowy fancy painted pictures beyond the boundary line

But the task we propose is to bring, if possible lights into the region as yet untrodden, and leave the tempting yet dangerous darkness till, at least, we have established one undisputed right of way to the debateable ground.

Here, then, is the problem which presents itself for solution—To determine the mechanical energy of thought during its propagation in a given medium Let us face it calmly, taking for our motto '*nec aspera nec terrent*,' humbly, too for we must tread with uncertain steps and slow

At the very outset we must feel our way We must ask ourselves if we are justified in assuming the *vis viva* of the disturbed medium to be an exact equivalent of the mental energy expended It is not an easy question to solve, but we have the great principle of the conservation of energy to assist us If this grand principle is universally true, we may answer the question in the affirmative and we change our base of operations to one which rests on whether the principle of the conservation of energy be true universally or not

The assumption that it is true universally, and, therefore, in the particular case under our consideration is one, I think, we are justified in making But I think we may even assure ourselves that the principle holds good even without the assumption

We will attempt to do so very cautiously

A thought, while it exists solely as a mechanical disturbance of the atoms of the propagating medium, is clearly intact, for it exists neither at its source whence it sprang, nor at its ultimate destination which, as yet, it has not reached It is complete and capable of being viewed in the imagination as isolated and in this form consists of the disturbed atoms in every possible phase of vibratory motion The transference of motion from atom to atom is successive, but there is no translation of the atoms themselves beyond their own periods of vibration and a series of these vibrating atoms constitute in all their possible phases a wave. Here we are simply travelling over well-explored paths, but it is, I think, necessary to dwell yet a little on this conception of thought in transference thus isolated

We may conceive it as being transmitted through a very long tube, air being the transmitting medium. We may view it as being at any given instant at a certain portion of this tube, so that we may cut it off by imaginary bounding planes, and enclose it completely. Between these planes all is in various stages of molecular disturbance; without them there is a state of rest.

The thought then is complete in the motion of the atoms of the medium transmitting it And in this condition it has attributes which are those of the transmitting mediums, and is subject to all laws to which that medium is subject. Its fate is completely bound up, in fact, with that of the medium, its existence being nothing more than a succession of phenomena produced by the phases of the atoms of the medium.

It may be urged that the work done by writing a particular letter is no guage of the work done by the mind in evolving that letter, but if it be true that the principle of the conservation of energy holds universally it does so in the particular. This, I think, we have established

But this principle holds if we conceive of the action occurring through two or more transmitting media, as, for instance, in the case of musical sounds, first transmitted by wooden rods, thence to a sounding box containing an elastic gas, such as air.

We have, in fact, the principle holding true in the various stages of the transmission, however numerous they may be. It is, in fact, true, for $n \times 1$ terms if true, for n terms, and that it is true for n intermediate terms, we have, I think, sufficiently shown, and, therefore, for its terminals. I think, then, we may take it that the work done is exactly guaged by the *vis viva* of the transmitting atoms.

When an important communication is received it reproduces in the recipient mental energy, the exact equivalent of the original mental force expended, and this mental energy may present itself again in a mechanical form. It is true that the conception of a thought by the consumption of brain-matter by oxidation probably performs side work on the organ of memory, but this is not the thought in transference to another mind foreign to the mind in which it had its origin

How often the happiness and destinies of nations have hung on the mechanical motions of the atoms of a transmitting medium! How often the sudden incarceration, perhaps, of these disturbed atoms or the compulsory breaking of their tiny waves on the shores of a rocky medium incapable of transmitting their feeble shock might have saved the sorrows of a cruel war.

ROADS IN MOUNTAINOUS TROPICAL COUNTRIES.

By Major James Browne, R.E., Assoc Inst. C E.

The object of this paper, which was read at the Institution of Civil Engineers on 3rd March, 1874, was to put on record precautions found necessary whilst making roads among the Himalayas at elevations reaching up to 24,000 feet, where the annual rainfall in some districts amounted to 220 inches, of which 170 inches fell in the two and a half months of the rainy season, and 5½ inches in one hour Mountain roads could be divided into two classes: those which crossed the main or higher ranges, and those which crossed the lower or subsidiary ranges The latter class generally presented the most serious engineering difficulties, owing to the greater quantity of water to be encountered In the higher ranges, the soil, being mainly composed of hard rock, did not allow every little stream let to cut for itself a deep and ever-increasing chasm, as in the comparatively soft soil of the lower ranges, and this circumstance rendered the bridging an easier matter. At elevations exceeding 8,000 feet attention must be paid to the action of the snow in winter. The best approach, in an engineering point of view, to the station of Dalhousie was through a ravine, so sheltered from the sun, that the snowdrifts remained unmelted for weeks and barred the way; and it had been found necessary, in consequence, to take the new cart-road through otherwise very unfavourable ground. At Rohtang, in Lahoul, a road well traced, but laid out in the height of summer, was impassable for the three spring months from incessant avalanches; one of which, ½ mile in length, and exceeding 100 feet thick, carried off a stone bridge of 40-feet span, and remained unmelted for more than six months.

In marking out the formation level, cuttings exceeding 10 feet or 15 feet in depth should as much as possible be avoided. In the stony soil of the hilly country no reliable information was to be got by boring;

and rock of the toughest and hardiest description sometimes cropped up where least expected. In the Himalayas, the northern slopes were thickly wooded, where the southern slopes were often quite bare. The former should be selected, notwithstanding the increased labour of tracing through the brushwood, as the road would be more durable. The trees broke the force of the rain, and the mould beneath passed it off gently over the road, which, on the bare hillside, would be cut away by the unchecked rush of water.

The general adoption of zigzags was not to be recommended; but much had been said against them which was open to modification. They entailed incessant repairs, if used in a wrong place—where the side slope was steep, the soil rotten, and the drainage such as to cross the road several times. But where these conditions did not prevail, the repairs were little, if at all greater, than in the same length of straight tracing. Again, where the reaches were short, and the turning places cramped, zigzags should not be tolerated; but where each reach was not less than 600 to 700 yards in length, and where a semicircular turn of not less than 50-feet radius could be obtained, the inconvenience was small, and the danger a minimum. Generally 5·55 in 100 was the steepest admissible gradient for an unmetalled mountain cart road in India. No earthwork became permanent under two rainy seasons. Landslips occurred with every shower and every hard frost. On the Dalhousie cart road the more cutting out of the hill-side to 14 feet in width determined a landslip upwards of 800 feet back from the edge of the road, and parallel to it for about 700 feet.

There were three different methods of making a road along the faces of vertical cliffs. The most expeditious was to form a gallery, carrying the road on cantilevers of iron or timber. This plan, however, was only suited for mule or bullock roads, and was inapplicable for cart roads. It had therefore been replaced by half-tunnels blasted out of the rock. From the nearest possible standing point a gangway of lashed scaffolding poles was run out horizontally along the face of the cliff, the near end being held down by two loaded jumpers, or by lewises let into the rock. A workman from the further end of the scaffold, drove into the rock a jumper-hole, slanting about 45°, which, when sufficiently deep, received an iron bar run with lead. To this support scaffolding was lashed, to act as a new starting point from which to advance another step. When the scaffolding, so supported had extended along the whole length of the cliff, arrangements could be made for fixing the permanent cradles and cross-beams to carry the gallery. On the Hindustan and Thibet road the galleries were 7½ feet wide, the supporting cradles being from 12 feet to 15 feet apart. The other modes of forming a road along the cliffs, were either by blasting in the usual manner, or by the use of mining galleries and heavy charges of powder. Where kunkur rock was met with, special cartridges were employed for blasting. This substance resembled petrified sponge, which, whilst allowing the powder to blow out through its pores, was so hard and tough as to defy the best steeled picks and jumpers.

On one section of the Hindustan and Thibet road, adjoining the glaciers, and where wood was abundant, blasting was abandoned for more than a year in favour of wood fire ... while the fuel lasted. The rock, when intensely heated, and then quickly deluged with snow water, cracked and broke up, at a great saving of time and labour.

The ordinary daily task of native quarrymen in boring was about 60 inches in sandstone or conglomerate, [illegible] inches in limestone, and from [illegible] inches to [illegible] inches in granite. In attacking a cliff with large mines, a line of [illegible] was first erected [illegible] the rock and [illegible] was driven into the rock, chambers being formed at the ends of return galleries to the right and left. The charges were placed at a horizontal distance from the cliff face of 2 feet more than the proposed width of the road, and generally blew out the rock on both sides to a distance equal to the line of least resistance. The galleries, which were 3 feet high by 2 feet 6 inches wide, could, in conglomerate, be driven at an average rate of 1 inch an hour, and at a cost of about 2s. per lineal foot. The rate of progress was three times and five times less in limestone or granite than in sandstone rock or conglomerate, which rendered mining a tedious operation. The galleries for the most part were chiselled with cold steel and not blasted. The most effectual mode of tamping mines in impracticable localities was by sandbags of date or palm-tree matting, containing about ½ cubic foot of damp clay. With these and a few half-bags and quarter-bags, the tamping was built up by native masons like an ordinary wall. Cushions of sand greatly increased the effect of the explosion. This systematic method of tamping could be done at the rate of 12 lineal feet an hour, or three times the rate of tamping with earth, in the usual manner.

Dry masonry retaining walls were largely employed on most Himalayan roads, many of them being of great dimensions and of some constructive difficulty. Sandstone, notwithstanding its clean splitting and good bedding, was by no means so suitable a material for retaining walls as granite or limestone boulders, being liable to disintegrate under tropical rains in damp situations, as in foundations below the level of the ground. Retaining walls of what seemed most compact sandstone had suddenly collapsed, the underground courses having dissolved into sand. Where expensive masonry in mortar was used, great economy resulted from the best possible shape and dimensions being given to retaining walls; but where cheap dry masonry was employed, earth should never be used for the backing, but the space should be filled with boulders or stone chips.

The mere excavation of a wide road along a hill side at once altered the whole system of natural drainage. It was useless to commence any drainage works until the annual rains had marked out a line of discharge across the great catchwater formed by the road. On some parts of the Lahore and Peshawur road the main drains were 25 feet wide by 5 deep. On the Kangra road, they averaged 10 feet wide by 3 feet deep. The smallest secondary drains should be 2 feet by 1 foot 3 inches; no cross drain, if provided with a movable slab top, being less than 2 feet by 2½ feet, or, if permanently covered in, less than 2 feet 3 inches by 2 feet 9 inches. To insure proper scouring, and an easy change of direction for the water, the cross drains had a slope of 1 in 12, and were built at an angle of 135° with the side drain, their ends being properly secured by boulder pitching. The main drainage was carried across the road through culverts, but more especially through large outlets in dry masonry retaining walls, covered in by stone slabs of from 2½-feet to 3-feet span. For larger spans, up to 10 feet, and where slate was procurable, dry rubble arches were built of picked stones neatly radiated and wedged up. Where building stone was scarce, concrete arches on dry masonry abutments were largely employed, the whole mass forming a monolith, rammed up in 4-inch horizontal layers. The Durroon Bridge, on the Kangra road, was 48-feet span in the clear by 20 feet wide. The arch was entirely composed of rammed mortar, consisting of 1 part of boulder lime, 1 part of pounded brick, and 1 part of sand, no broken stone whatever being used.

The shape generally given to the metalled road-surface on a mountain side was a slope of 1 in 18 from the outside to the inside. It had been objected to this slope that it converted the road into a drain, which was cut away and became impassable in heavy downpours; and on some of the Madras hill roads the slope was from the inside to the outside. Both systems had their respective advantages; but on the whole, the inside slope was preferable when the cross-drains were sufficiently large and numerous, and the side drains rocky or properly protected by boulder paving. The usual practice was to adopt the outside slope until the drains were built and the side-slopes had taken their bearings, when, as a permanent arrangement, the road was finished and metalled with an inside slope. The metalling consisted of a 9-inch layer of broken granite, kunkur rock, or coarse slate shingle, and did not materially differ from an ordinary macadamised surface. The usual width of a mountain cart-road varied from 18 feet in open ground to 12 feet along cliffs, or in difficult places; the maximum gradients varying 1 in 18 to 1 in 25.

Proceedings of Societies.

ROYAL SOCIETY.

FEBRUARY 26TH.—The President in the chair.—The following papers were read:—"The Winds of Northern India in Relation to the Temperature and Vapour Constituent of the Atmosphere," by Mr H. F. Blanford; "On White Lines in the Solar Spectrum," and "Note on Displacement of the Solar Spectrum," by Mr. J. B N. Hennessey.

March 12th.—The President in the chair. —The following papers were read:—"Contributions to the Developmental History of the Mollusca: Loligo, Aplysia, Pisidium," by Mr. E. Ray Lankester, and "Description of a new Deep-Sea Thermometer," by Messrs. Negretti and Zambra

SOCIETY OF BIBLICAL ARCHÆOLOGY.

TUESDAY, MARCH 3RD.—Dr. Birch, F.S.A., President, in the chair.

The following candidates were duly elected Members of the Society:—Rev. Charles Bowden, M.A.; Rev. A. Paine; and Miss E. Rogers. The following papers were then read:—

1. Translation of an Egyptian Fabulous Romance, "The Tale of the Doomed Prince." From the Harris Papyri. By C. W. Goodwin, M.A. -This curious romance, which is unfortunately only a fragment, relates how a certain Egyptian King, in answer to his earnest prayers, obtained a son, of whom the Seven Athors (Parcæ) foretell that he will die by one of three deaths, either by a crocodile, a serpent, or a dog. To preserve his son, the king shuts him up in a tower with every luxury, and numerous attendants, who are charged to tell him nothing of the existence of these three animals. One day the prince sees an Egyptian go forth to hunt, accompanied by his dog, whereupon the prince desires such an animal. This leads to the disclosure of his destiny; but he worries his father into letting him have his way, saying it is useless to fly from fate. After that he also prevails upon the king to let him go out and see the world. Agreeably to this wish he travels alone to Naharanna (Mesopotamia), and passes as the son of an Egyptian horseman fleeing from the cruelty of a step-mother. Arrived at the court of the monarch of the country, he mingles with the courtiers, by whom he is told of the singular circumstances surrounding the king's daughter, who is shut up in a tower, from whence she can only be liberated by that lover who shall successfully scale the window of her prison. All the princes of Naharanna try to do this, and fail; but the young Egyptian, whose personal appearance wins the heart of the princess, is successful. Upon this the king her father refuses to give her in marriage to an unknown fugitive; but as she threatens suicide in the event of being refused, he

consents, and the lovers are united. Soon after the prince and his wife return to Egypt on a tour, and entering one of the temples to worship, he is attacked by a sacred crocodile, which he repels, and also by a giant, whom he overcomes. Weary with his exertions, the prince returns home to rest, while his wife watches beside him. Presently a serpent comes out of a hole to sting him during his sleep; but the princess offers the reptile some intoxicating drink, and when it is drunken, drowns the creature in her bath. On the prince awaking, he and his wife offer prayers and thanks for his deliverance from two of the foretold dooms. He then goes out for a walk, and is again met by the giant and crocodile, who warn him of his certain fate, to which he pays no heed. Two months afterwards the prince walks out, taking his dog with him, at this crisis the romance is suddenly broken off by the loss of the remainder of the papyrus. The learned translator drew attention to the peculiar features of this ancient story, resembling in so many points the romances of the mediæval period, which may have had a common origin.

2. Translation of an Historical Narrative belonging to the Reign of Thothmes III.—By C. W. Goodwin, M.A.—This translation, the original text of which is also contained in the Harris Papyri, relates the manner in which a certain chief officer of state, named Tahutia (*Thoth*), treacherously delivered up the fortress of the Inu (a people hitherto unknown to Egyptologists) to the armies of King Men-cheper ra (Thothmes III.), and enumerates further the amount of the spoil thus surrendered, and the rewards obtained by the traitor.

3. Observations upon the Assyrian Verbs Basu and Qabah.—By Prof. William Wright. This paper consisted of a critical analysis of the roo s of the above verbs, and their cognatet analogues in other Semitic languages.

ASTRONOMICAL SOCIETY.

March 13th.—Professor Adams in the chair.—The following were the papers read: —"Notes on some Spectroscopic Observations of Sirius and γ Argus, &c.," by Mr. Pringle; "On the Structure of the Solar Photosphere," by Mr. Langley; "Notes to Accompany Chromo-lithographs from Drawings of the Planet Jupiter," by the Earl of Rosse; "Occultation of Neptune," by Mr. Talmage; "Note on the Zodiacal Light," by Mr. Knobel; "On the Obituary of the late Temple Chevalier," by Mr. Carrington; "On the Relative Magnitude of the 5th and 6th Stars in the Trapezium of Orion," by Mr. Barneby; "On Two Ancient Conjunctions of Mars and Jupiter," and "On the Zodiacal Light," by Mr. Johnson; Second paper "On the probable Variability of some of the Red Stars of Schjellerup's List," by Mr. Birmingham; "Note on the Curvature of the Lines in the Dispersion Spectrum and on a Method of Correcting it," by Mr. Christie; "On a Method of Drawing by Continued Motion an Approximation to a Parabola," by Mr. Penrose; "On a Remarkable Structure visible upon the Photographs of the Solar Eclipse of December 12, 1871, by Mr. A. C. Ranyard; "On the Solution of the Equations in the Method of Least Squares," and "Remarks on Two Papers of Mr. Stone on the Treatment of Observations," by Mr. J. W. L. Glaisher; and "On the Determination of Longitude by Chronometers by the late Capt. H. F. Murphy," by Mr. Locky.

GEOLOGICAL SOCIETY.

February 20th.—Annual General Meeting. —His Grace the Duke of Argyll, President, in the chair. The Secretary read the Reports of the Council, and of the Library and Museum Committee. The general condition of the Society was said to be satisfactory. After presenting the medals and proceeds of the Murchison and Wollaston Funds, the President read his Anniversary Address. The Address was prefaced by some obituary notices of Fellows and Foreign Members and correspondents deceased during the past year, including Mr. J. W. Flower, Mr. J. G. Marshall, Prof. Agassiz, and M. de Verneuil. The ballot for the Council and officers was taken, and the following were duly elected: President, J. Evans; Vice-Presidents, R. Etheridge, R. A. C. Godwin-Austen, Sir C. Lyell, Bart., and J. Prestwich; Secretaries, D. Forbes and Rev. T. Wiltshire; Foreign Secretary, W. W. Smyth; Treasurer, J. G. Jeffreys; Council, the Duke of Argyll, H. Bauerman, Prof. G. Busk, J. F. Campbell, F. Drew, Sir P. de M. G. Egerton, Bart., M.P., R. Etheridge, J. Evans, D. Forbes, Capt. D. Dalton, R. A. C. Godwin-Austen, J. G. Jeffreys, Sir C. Lyell, Bart., C. J. A Meyer, J. C. Moore, J. Prestwich, Prof. A. C. Ramsay, S. Sharp, W. W. Smyth, Prof. J. Tennant, W. Whitaker, Rev. T. Wiltshire, and H. Woodward.

February 25th.—J. Evans, Esq., President, in the chair. Mr. A. J. Jukes-Browne and the Rev. M. H. Close were elected Fellows. The following communications were read: "Geological Notes on a Journey from Algiers to the Sahara," by Mr. G. Maw,—"On the Trimerellidæ, a Palæozoic Family of the Palliobranchs or Brachiopoda," by Mr. T. Davidson and Prof. W. King,—and "Note on the Occurrence of Sapphires and Rubies *in situ* with Corundum, at the Culsageo Corundum Mines, Macon Co., North Carolina," by Col. C. W. Jenks.

March 11th.—J. Evans, Esq., President, in the chair. Messrs. H W. Jackson, R. Winn, M.P., E Stutchbury, R. Carter, E. W. Hawker, D. R. Irvine, J. Horne, and A. W. Howitt, were elected Fellows; and Prof. E. Desore, of Neuchâtel, and Prof. A. Gaudry, of Paris, were elected Foreign Members. The following communications were read: "On the Relationship existing between the Echinothuridæ, Wyville Thomson, and the Perischoechinidæ, M'Coy," by Mr. R. Etheridge, junr.,—"On the Discovery of Foraminifera, &c., in the Boulder-Clays of Cheshire," by Mr. W. Shone, junr.,—and "On the Occurrence of a Tremadoc Area near the Wrekin in South Shropshire, with Description of a New Fauna," by Mr. C. Callaway."

VICTORIA (PHILOSOPHICAL) INSTITUTE.

A meeting of this Institute took place recently, when a paper on the Rules of Evidence as applicable to the Credibility of History was read by Mr Forsyth, Q.C., M P. The proceedings were commenced by the election of several new members, including Professors Swainson and Challis, Colonel Hogg, M.P., and others; after which letters expressing regret at being unavoidably prevented from being present were read from the Duke of Argyll, K.G.; Lord Malmesbury, Lord J. Manners, Lord H. Lennox, the Right Hon. Sir S. Northcote, Bart., Gathorne Hardy, R. A. Cross, Colonel Taylor, Sir J. Karslake, Sir B. Frere, Vice-Chancellor Cookson, Professors Chandler, Palmer, and others. After which Mr. Forsyth read his paper, which, starting with the axiom that it was as irrational to believe without any evidence, as to disbelieve against sufficient evidence, proceeded to analyse the amount of evidence which has, in the record of various events, been deemed sufficient to entitle those events to credit, and concluding by giving that referring to religion. An interesting discussion ensued.

THE INSTITUTION OF CIVIL ENGINEERS.

Tuesday, March 3rd, 1874.—Thos. E. Harrison, Esq., President, in the chair.—The first paper read was on "The Great Basses Lighthouse, Ceylon," by Mr. William Douglass, M. Inst. C.E.

As early as November, 1836, the late Sir J. J. Gordon Bremer, R.N., and the late Capt. W. F. Dawson, R.E., made an examination of the S. and E. coasts of Ceylon, one of the results of which was the recommendation for the erection of a beacon on the Great Basses. It was not until 1856, however, that the authorities gave instructions for the preparation of a design for the work. This design, submitted by the late Mr. Alexander Gordon, M. Inst. C.E., was for a cylindrical cast-iron tower, secured within an enlarged basement of masonry, which basement was to be inclosed within an outer casing of cast iron, and both tower and casing were to be sunk into the rock. Mr. Gordon's estimate for the work amounted to £33,946, and that sum having been sanctioned by the Board of Trade, Mr. W. W. Poingdestre was appointed the resident engineer, and left England for Ceylon in March, 1856. After three years' operations, and the expediture of about £40,000, only a few landings had been effected on the rock, and the authorities therefore suspended further proceedings.

In June, 1867, the whole question, as to the practicability, probable cost, and reasonable chance of success of the erection of a lighthouse on the Great Basses, was referred to the elder brethren of the Trinity House, who recommended for approval a design prepared by their engineer, Mr. J. N. Douglass, M. Inst. C E. That design was for a granite structure, in which the base of the "Gordon" Lighthouse was proposed to be utilized. The plan further included a lantern and dioptric revolving apparatus of the first order; also a light vessel, to be moored off the rock, for exhibiting a red revolving light every night during the progress of the work, and to serve as a barrack for the executive engineer and staff. The total estimated cost of the works was £64,661. The design having been approved by the Board of Trade, and the Trinity House having agreed to undertake its execution, the necessary funds were voted by Parliament, and the work was immediately proceeded with. The author, who was then building the Wolf Rock Lighthouse, was appointed the executive engineer. The lighthouse consisted of a cylindrical base, 30 feet in height and 32 feet in diameter, on which was placed a tower, 67 feet 5 inches in height, 23 feet in diameter at the base, and 17 feet in diameter at the springing of the curve of the cavetto. The thickness of the wall was, at the base of the tower, 5 feet, and at the top 2 feet. The accommodation within consisted of six circular rooms, each 13 feet in diameter. There was also a room 12 feet in diameter in the basement, for coals and water, and a rain-water tank below, 7 feet 6 inches in diameter. From the floor of the tank to the rock, a depth of 11 feet 6 inches, the building was solid. The tower contained 12,288 cubic feet of granite, and the cylindrical base 25,077 cubic feet, making a total of 37,365 cubic feet, weighing about 2,768 tons. The stones forming the wall of the tower were dovetailed, both horizontally and vertically. Medina cement was used for the first and second courses, and Portland cement for the courses above these. The cylindrical 14 feet lantern of the Trinity House was adopted. The dioptric apparatus had eight panels of refractors, with upper and lower prisms, for emitting flashes of red light at intervals of 45 seconds. A 5-cwt. bell, for a signal during foggy weather, was fixed on the lantern gallery.

The Great Basses reef was 20 miles to the eastward of Point de Galle, and 6 miles from the nearest land. It was about ½ mile long, ¼ mile broad, and was composed of hard red sandstone. The reef was exposed to both monsoons; therefore the days available for working on it were few. The only suitable season was during the N.E. monsoon, which commenced in November and terminated in April, the best months of the monsoon being the first and the two last. The coast for many miles on both sides of

the Basses reef was almost continuously exposed to a heavy surf, and was without secure shelter for shipping. It was determined therefore to form at Galle a depôt, from which the operations at the rock were to be carried on. Two iron twin-screw steamers, each capable of carrying 120 tons of cargo, at a speed of 10 knots, were used for conveying the materials from the work-yard at Galle to the rock, and for attending on the light vessel and floating barrack. The steamers were each fitted with two steam doubled-barrel winches, by which the stones of the tower were hoisted on board, stowed below, hoisted again to the deck, and from thence to the rock. The author was of opinion that this was the first instance of material being landed in a seaway from a vessel by means of her own steam power, excepting where the load could be deposited by her own swinging derrick. Although it was necessary to moor the steamers, when laden, at a distance of 30 fathoms from the rock, stones weighing on an average 2½ tons were by means of these winches hoisted out of the hold, landed, and deposited 28 feet above the rock, at the rate of ten per hour. On the 8th November, 1869, the author left England, and on the 7th March, 1870, landed on the rock for the first time. The building of brick dam round the seaward side of the foundation was at once proceeded with. It had since been faced with small ashlar and coped, and now formed a useful portion of the landing platform—also constructed of rubble stone in cement, and faced and coped with granite ashlar. This platform contained 10,443 cubic feet of masonry, making, together with the tower and base, a total of 47,808 cubic feet, or about 3,541 tons. The season ended on the 3rd May, when 36 landings had been effected, and 220 hours worked on the rock. The first landing of the season, 1870-71, took place on the 28th November, and the last on the 28th April. During this season 84 landings were effected, and 651 hours worked on the rock. The first stone was landed on the 28th December, and at the close of the season sixteen stones of the 21st course were set. The first landing for the season of 1871-72 took place on the 10th of November, and the last on the 2nd May. During the season, 74 landings were effected, and 679 hours worked on the rock. The remaining portion of the tower, from the 21st course, was set, and the framing of the lantern erected. The number of working days of ten hours, from the first landing on the rock to the end of the season 1871-72, was 155 days 3 hours; and from laying the first stone of the tower to setting the last stone of the gallery course 110 days. The staff comprised thirty-three Europeans, including an executive engineer, a chief foreman, an accountant, officers in charge of the vessels, seamen and mechanics, and fifty-one native seamen and workmen.

The light was exhibited on the 10th March, 1873, and had since been continued with regularity every night, from sunset to sunrise. The illuminant adopted was Ceylon cocoa-nut oil, at a price of about 2s. 2d. per gallon. The work was executed without loss of life or of limb to any person employed. The total cost of the undertaking was £84,300, being £361 below the original estimate.

The success attending the execution of this work had induced the authorities to order the erection of a similar lighthouse on the Little Basses reef, in accordance with a special design and estimate furnished by the engineer of the Trinity House. The Corporation of Trinity House had undertaken the execution of this work also, and the author was now employed in carrying it out, the vessels and plant from the work at Great Basses having been transferred and adapted for that purpose.

At the monthly ballot the following candidates were balloted for and declared to be duly elected:—Messrs. A. W. Baird, A. H. McDonald, and J. A. Paskin, as Members; and Messrs. R. Ballard, C. Brown, Stud. Inst. C.E., T. Duerdin, Stud. Inst. C.E., M. Graham, Stud. Inst. C.E., G. G. M. Hardingham, Stud. Inst., C.E., Lieut.-Col. C. S. Hutchinson, R.E., Messrs S. H. James, H. Leupold, M. Longridge, F. B. Maclaren, J. C. Searle, Stud. Inst. C.E., C. W. Whitaker, and A. Woods, as Associates.

It was reported that the council, acting under the provisions of the bye-laws, had recently transferred Messrs. J. Gordon and J. Tomlinson, jun., from the class of Associate to that of Member; and had admitted the following candidates as Students of the Institution, viz.:—Messrs. J. E. Catton, W. P. Churchward, H. H. Hely, W. H. Jones, W. G. Kerle, J. E. Paul, and W. Pole, jun.

Correspondence.

A PHRENOLOGIST ON THE CLAIMANT.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—Now that the time has come when "public opinion" may freely vent itself regarding the Claimant of the Tichborne Estates, perhaps a few words concerning his phrenological characteristics may be offered to "public notice" without fear on the part of either publisher or author. Of course, the idea will suggest itself to everyone that the phrenologist is always wise after the fact. In this case, however, no attempt will be made to appear wise in the matter, the object of this letter being only to direct attention to such characteristics of the late Claimant as have been published during his trial, that others, besides the phrenologist, may observe for themselves whether the same at all tally phrenologically with his portraits which everywhere abound. One particular faculty of the mind that especially claims our attention here, is that which, in the phrenological nomenclature of the mental faculties, is called language. Its function is to observe and remember words, sentences, paragraphs, &c. All persons possess this faculty, but some in a greater degree than others. While some find it difficult to command words to express their ideas, others, after once reading a newspaper through, are able to repeat it verbatim from beginning to end. This faculty should certainly not be wanting in Arthur Orton, or whatever his name is, to justify the idea that his knowledge of so many incidents of the life of Roger Tichborne had been acquired from the associates of the veritable Sir Roger. The question now arises, does his *organ* of language agree in development to the power of this proclivity? Does his portrait show the eye to be full enough and sufficiently projecting to indicate that the organ of language is well developed? Or is it a sunken eye, which shows that the organ of language which lies immediately behind it is of defective development?

It is now universally agreed, with one exception (Dr. Carpenter), that the organs of the intellectual faculties occupy the frontal or anterior region of the head: those of the moral sentiments (peculiar to man) the coronal or superior region, and that the propensities (which are common to man and animals), have their seat at the lower and posterior region of the head. In this particular it will be seen that phrenology teaches that when a man is led by his propensities he is, as it were, going backward, when by his intellect, he is going forward; and when by his sentiments he is going upward.

On looking at the portrait of the gentleman from Wagga-Wagga, it will be seen that the contour of the head shows a lack of height, while the lower and hinder parts are broad and heavy. In these respects it resembles the casts of Rush, Palmer, and Pritchard, which by phrenologists are regarded as a type which imports coarseness and brutal sensuality. These qualities are indicated less by a development of the organs of the propensities, than by their being unaccompanied with a fair development of the organs of the moral sentiments. Consonant with such an organisation, we hear, from his own confession, that the life of the Claimant has been one of crime, drunkenness, and debauchery. It is when the organs of the moral sentiments are low, there is no compunction about what is said, thought, or done. The innocent may be slandered or defamed; a fellow-creature despoiled or injured; but honour is so cramped and confined that there is no room for it to swell into remorse. Hence it is with this type, that there being nothing within to make a criminal life unbearable, the struggle is so great, and the trial is so long, when such a life is about to receive a check. It will be recollected that the trials of the noted law-breakers before alluded to extended over some considerable time. All this, however, does not negative the fact that there are hundreds of thousands of the same type who never commit themselves. For, be it remembered, the circumstances of many are easy, and admit of the gratification of their propensities without their having recourse to illegitimate means. It is, no doubt, known to every judge and councillor, that if it was not for this type he would soon have to "shut up shop." It is difficult, if not impossible, to find one of the low sensual type doing the work of Plimsoll, Dr. Manning, or Viscountess Burdett-Coutts, whose heads form such a striking contrast to those before mentioned. Suspend the vigilance of the police but for a single night, and we should soon get a notion of where the organs of the moral sentiments are that keep in subjection the animal propensities of many. And now for the remedy. Let it form a part of every child's education to be careful when they grow up how they indulge children even while in arms, for parents frequently encourage in them children desires which, though harmless in infancy, tend by degrees to pernicious habits. If the babe should fall and hurt itself, never attempt to appease it by beating the place it fell against. If one child should hurt another, which is often done in their play, let the one hurt not seek to resent the injury, but rather to forgive it. Mrs. Child, in her book "The Frugal Housewife" gives this useful piece of information. She says:—"In early childhood, you lay the foundation of poverty or riches in the habits you give your children. Teach them to save everything—not for their own use, for that would make them selfish—but for some use. Teach them to share reasonably with their playmates, but never allow them to destroy anything." And it is by pampering children that habits of laziness and intemperance are generated, whose constant attendants are poverty and disease, out of which spring the many vices that lead to bad ends. Such are the practical suggestions of phrenology for checking the growth of mental inequalities.—I am, Sir, yours respectfully,

A. L. VAGO.

*** [We gladly afford space for the above, because we think that phrenology, especially when handled by any one so earnest and moderate as Mr. Vago, has too much promise of utility in estimation of human character to be pooh-poohed, and not in any way as an expression of our opinion upon its tenour or on the value of the application of phrenology to such a person as the Claimant, especially without personal manipulation.—ED. S. and L. R.]

COMMUNICATION IN TRAINS.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—On reading your issue of the 1st inst., I find a somewhat able paper on "Railway Train Communication," by C. F. Roe, Esq., introducing to notice an invention by Mr. R. Stapleton. Doubtless the inven-

tion would work, but I think the wear and tear of continued motion would soon produce leakages in air tubes, and render them worthless. I should be sorry to be thought applauding the sound of my own trumpet—as I regret to be the only means of bringing an invention of my own before you. But I am perfectly convinced that Mr Stapleton's invention must yield to mine. I need not, perhaps, advert to its peculiar advantages over anything I have heard of or seen, as my invention will appear in the International Exhibition of this year, and I do earnestly solicit the inspection of my invention by scientific men, which I believe will operate very favourably on their minds. My apparatus is durable, being all iron; a child may work it; and guard and engine-driver may communicate with each other independent of the passengers, and may even talk to each other on two small bells—one on the engine-driver's tender and the other in the guard's box. I have two other inventions essentially connected with railway traffic which will appear on my model carriages at the International at the same time.—I am, Sir, your obedient servant,

JOHN WYATT.

Rose Cottage, Slopton,
March 7th, 1874.

APPLICATIONS FOR LETTERS PATENT.

(Continued from page 46.)

—G. Hastletine. Hinges (com.)—H. Highton. Electric telegraphs.—H. B. Barlow. Embroidering machines (com.)—J. C. Browne. Apparatus for raising, forcing, and exhausting water, air, or other fluid, also for lifting, directing, and guiding balloons and flying machines.

On December 31st. — 4280 to 4294. — B. Hunt. Printing presses and machinery or apparatus connected therewith (com.)—B. Walker, jun. Apparatus applicable to bobbin net or twist lace machines and warp lace machines.—G. Clark. Pavements.—W. M. Ward. Mills or crushers for grinding or crushing mineral and other substances for mixing mortar and cement, and other like purposes. — J. J. Bodmer. Treatment of peat, sewage deposit, and substances used in the manufacture of artificial manure, and in the application of part of the said materials as fuel, and as parts of compounds for metallurgical operations. — W. H. Beckitt. Valves.—G. A. Wuth. Extracting and utilising waste, fatty, and colouring matters contained in the washings of print and dye works (com.)—J. Mackintosh. Moulds for casting metals.—W. R. Carr. Boring machine.—G. H. Williams. Collar for horses or other animals.—B. Hunt. Manufacture of nutritive hygienic compounds or preparations (com.) (Complete specification.)—J. H. Johnson. Puddling iron and steel, and the machinery employed therein (com.)—J. H. Johnson. Blowing machines (com.)—G Skinner. Extension ladders.—A. M. Clark. Manufacture of gas and fuel (com.)

On January 1st.—1 to 18.—W. Cotter. Telescopic or folding combined bedstead and air bed.—J. Fowlie. Harness or arrangements used for traction by animal power and when carrying loads upon animals.—J. Lamont. Manufacture of illuminating gas, and apparatus or mechanism connected therewith.—G. Duckett. Size and the method of sizing. — W. Morgan-Brown. Uniting leather work, in the fastenings for that purpose, in the mechanism for making such fastenings, and in the mechanism for drawing said fastenings (com.) — R. Gothell. Apparatus for measuring the heat of fluids passing through pipes (com.)—J. Parker. Apparatus for rolling railway carriage and other wheel tyres. — L. Leon. Fire-escape or apparatus for saving life in case of fires, applicable also for facilitating descent over ships' sides, and for other similar purposes.—L. M. Becker. Shuttles, spools, and bobbins for sewing machines and other purposes. — J. H. Johnson. Manufacture of steel (com.) (Complete specification.) — H. B. Barlow. Apparatus for delivering and drawing long fibred wool after carding (com.) — W. Abbott. Ships' boats.—P. Jensen. Breech-loading fire-arms.—H. A. Bonneville. Printing press (com.) (Complete specification.)—H. A. Bonneville. Copying press (com.) (Complete specification.)—L. Deny. Forming strainers, and improved tool for preparing perforated metal plates for the same.—G. A. Buchholz. Obtaining motive power. — J. H. Johnson. Treatment and preservation of textile materials and fabrics, wood, ligneous substances, and paper and the dressing or product employed therefor.

On January 2nd.—19 to 36.—S. H. Johnson. Method of and apparatus for separating free sulphur from substances with which it is mixed. —A. Dudgeon. Method of utilising the heat of furnaces in the generation of steam.—R. Gottheil. Apparatus for washing, opening, drying, and oiling wool, and for regulating the supply of soap solution and oil thereto (com.)—A. Dudgeon. Manufacture of peat for fuel.—W. B. Robins. Hydronettes, hand pumps, and syringes.—F. Curtis. Lamps (com.) (Complete specification).—R. Gottheil. Motors to be worked by gas (com.)—Rev. G. H. Forbes. Manufacture of gas for illuminating and heating purposes.—R. W. Page. Actuating the valves of steam engines.—Rev. G. H. Forbes. Compound to be used as fuel.—H. T. Green and C. W. Price. Brakes for railway trains.—R. A. Threlfall, W. Hamer, and J. Bond. Polishing fluted rollers used in machinery for preparing and spinning cotton and other fibrous materials. —W. Sutherland. Painting, gilding, silvering, and ornamenting the surface of glass and protecting the same from injury.—T. Lancaster. Supplying fuel to steam boiler and other furnaces and fire grates, and in fire bars to be used therewith.—A. V. Camp and G. Clark. Road street, and pathway pavements.—G. H. Forbes. Compounds designed for the manufacture of cements, plaster, or artificial stone, capable also of being used for artificial fuel.—G. Haseltine. Combined high and low pressure steam engines (com.) (Complete specification).—R. Gottheil Apparatus for dying warps (com.)

On January 3rd.—37 to 50.—S. Cohne. Composition for axle and shaft and spindle and other similar bearings, and the manufacture of bearings therefrom.—G. Chapman. Making sesquicarbonate of ammonia.—H J. Westrup. Apparatus for indicating the position of the rudder in vessels.—J. T. Emslie. Registering the number of passengers or people entering or leaving tramway cars, omnibuses, &c.—H. M Nicholls Apparatus for cutting continuous paper into sheets, and piling or disposing of the same when cut.—A. Higginson. Governors for motive-power engines.—J. Petrie. Apparatus for scouring or washing and dyeing wool and other fibrous materials.—J. Harrington. Locks or fastenings.—J. Paterson. Apparatus for capsuling bottles and other vessels.—J. Lancaster. Horses-shoes.—J Peel. Looms for weaving.—J. Hotteley. Construction of propellers, and the arrangement or method of fitting them in vessels for the propulsion thereof.—E. T. Clark. Apparatus for teaching infantry drill.—W. A. Gibbs. Apparatus for drying.

On January 5th.—51 to 60.—J. McNeil and W. Maugeorge. Circulating water-tubes for boilers, and method for forming the same.—W. Poulson. Appliances or apparatus to be used in unloading bulk cargo from ships.—D. C. Knab. Preventing the incrustation of boilers and the apparatus connected therewith.—W. R. O. Chamberlain. Electro motive-power.—R. G. Ferry. Kilns or drying chambers for drying peat, malt, grain, brewers' or distillers' grains, hops, or other similar substances.—N. A. Delavigne. Corkscrew.—H. Aitken. Coking coal and other carbonaceous matters, and in the apparatus employed therefor.—G. T. Bousfield. Rotary engines and pumps (com.) (Complete specification.)—A. C. Andrews. Machinery to be used in the manufacture of boots and shoes.—P. G. B. Westmacott. Hydraulic capstans and such like hauling machinery, partly applicable to mounting hydraulic engines for giving motion to other machinery.

On January 6th.—61 to 75.—E. Molyneux. Apparatus for extracting [illegible] from the comminuted leaf.—S. Rawsthorne and J. Hartley. Size and finishing yarn when dried.—J. [illegible]. [illegible] indiarubber valves, tubes, and other like articles from chemical [illegible].—[illegible]. Structure of furnaces and apparatus connected therewith for manufacturing iron and steel [illegible] metals by the use of hydrocarbon vapours or gas, combined with or without [illegible] for heating purposes [illegible] apparatus or means for [illegible] powder.—A. Browne. Apparatus for raising sunken and wrecked vessels (com.)—G. C. L. Leson. Apparatus for holding chain cables.—F. Holmes. Machinery for polishing stone, marble, and other hard substances.—A. M. Clark. Combustion of fuel and generation of steam in furnaces (com.) (Complete specification).—A. M. Clark. Apparatus for regulating the pressure and friction of fluids (com.) (Complete specification).—J. Harrington. Treatment of the "splits" and "fleshes" of skins or "hides," and of "buffed leather," and of leather or skins, the grain of which is imperfect, in order to render them suitable to be employed for most purposes to which good surfaced leather is applied.—W. E. Newton. Process for preparing hydrate of magnesia (com.)—J. H. Johnson. Warming railway carriages (com.)—J. Steel and J. McInnes. Apparatus for actuating the brakes of railway carriages by compressed air, part or parts of which are also applicable for signalling in railway trains.—S. W. Wilson. Electrical-brake apparatus for railway purposes.

A new high-class illustrated weekly newspaper made its first appearance on the 7th March. The title is *The Pictorial World*. The list of artists and contributors comprises many well-known names; and as the paper is published at a popular price—threepence—a large circulation is anticipated for it by its projectors.

Mr. Warren, of Manchester, announces a new peat fire-lighter, which needs neither paper nor chips.

Professor James Orton, of Vassar College, whose interesting letters descriptive of his recent exploration of the great Amazon river have from time to time appeared in the columns of the *Scientific American*, has arrived safely home, and has resumed his duties in the class of Natural History and Zoology.

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THE

SCIENTIFIC AND LITERARY REVIEW,

AND RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,

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, Communications to the Editor to be addressed to him at 21, Cockspur Street.

CONTENTS.

THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

Chairman of the Council—SIR ANTONIO BRADY.

THE various efforts which have been made, and the numerous influences now at work to injure if not to destroy, Patent Rights, the insufficiency of the many well intended, but ill considered, schemes of Patent Law Reform which have from time to time been suggested, and the tendency of which has generally been to prejudice the Inventor, without advantage to the Public; together with the proceedings so essentially involving the interests of inventors which have already taken place in Parliament, shew the necessity of an immediate and active co-operation on the part of those interested in Inventions and in Patent Property, and that an Association for the Protection and Defence of Patent Rights is urgently needed. This Institute has, therefore, been established for the purpose of uniting and organizing the influence of Inventors, Patentees, and others. Its objects are:—

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Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur-street, Charing Cross.

On January 7th.—78 to 97.—J. C. Johnson. Twist lace machines.—J. Fottrell. Artificial stone pipes and tubes, and coating or lining thereof, to render them suitable for the conduit of alkaline liquids and acid products from chemical, manure, and gas works, for sewage, saline liquids, and gas.—J. Mansley. Compound engine for the working of all kinds of machinery.—G. Bramwell. Production of agents for giving or restoring colour to or improving the appearance of the human hair.—W. R. Lake. Adjustable or fast and loose pulley (com.)—H. C. de Vogt. Apparatus for navigating the air.—F. W. Fox. Apparatus for combing wool or other fibrous substances.—S. Bramall. Double-acting and continuous brake for railway carriages and waggons.—W. H. Brookes. Pumps.—J. Marshall. Threshing machines.—T. Cain. Hollow bags for furnaces or fire-grates.—J. F. Corkran. Improved manure (com.)—D. Davies. Steam boilers.—A. B. Cruickshank. Cleats for holding the sheets in sailing boats.—W. H. Barlow, jun. Pens.—W. E. Gedge. Construction of windows for ventilating cars, dwellings, steamboats, and other like places, and in attachments thereto (com.) (Complete specification).—C. E. Blake. Improvements in dentistry (Complete specification).—J. Webster. Mounting and working converters employed in the manufacture of steel and other metals.—W. R. Newton. Electro-magnets and application of the same for obtaining motive-power (com.)—W. Andrews. Sewing machines.—G. Haseltine. Machine for testing and registering or recording the strength, elasticity, and ductility of wood, iron, and other materials (com.) (Complete specification).—H. H. Murdoch. Obtaining potash from the "yolk" of wool and from the residuum of the distillation of beetroot juice or of molasses (com.)

On January 8th.—98 to 118.—A. Miller. Rendering, purifying, and bleaching tallow, lard, and other fatty matter (com.)—F. Mason. Lead or type-metal stereotype block for mounting and fastening stereotype blocks and other similar plates on.—A. May. Process for obtaining in virtual effects or motions the animation of drawn figures by the help of two images combined in order to represent the two extreme positions of a motion, appearing and disappearing in turn before the eyes (com.)—W. F. Reynolds. Ships' compasses and means for regulating and adjusting the same and other compasses thereby.—J. F. P. Woodley. Machinery employed in the manufacture of wood [illegible].—D. Williams. Anchors.—D. Davies. Regulating the speed of

[illegible] engines.—J. Atkinson. Cap or head-dress for travelling or resting the head.—R. Newton. Fire bars.—W. E. Gedge. Embroidering machine known as the "Bonnaz Cornao-Brodeur" by the application of a braiding apparatus (com.)—W. J. Vernon. Closing or stoppering of aerated liquid bottles having internal stoppers.—H. Negretti and J. W. Zambra. Thermometers used in deep sea soundings.—H. A. Bonneville. Coal small waggons (com.)—J. L. Clark and J. Standfield. Floating docks and pontoons.—J. F. C. Farquhar. Gas burners.—J. Lazenby. Umbrellas, parasols, and sunshades.—J. Holden and J. E. Holden. Machines for washing wool.—W. Cox. Sacks or bags.—J. Robertson. Indicating and registering the number of persons who enter and leave tramway cars, omnibuses, public halls, steamboats, or other places of public resort.—W. Lighbody. Lamps.—W. Marshall and T. A. Crosskill. Wringing and mangling machines.

On January 9th.—119 to 132.—J. B. Hamilton. Musical instruments. (Complete specification).—G. S. Fleming. Apparatus applicable to candles when burning.—M. Benson. Pump valves (com.) (Complete specification).—G. W. Dyson. Apparatus for rolling metals and other bodies or substances.—G. H. C. Hedley. Improved fire-lighter.—E. T. Truman. Manufacture of insulated telegraphic conductors, and machinery for their manufacture.—W. Pindar and A. G. Pindar. "Silk" machines for dressing flour, part of such improvements being applicable for sieving or sifting other powdered or pulverised material.—H. Pooley, jun., and J. Greenwood. Weighing machines.—W. Munnab. Steam boilers.—J. Woodward. Manufacture of blocks or slabs for paving.—T. S. Bennett. Pickers.—W. E. Gedge. Steam generator applicable to stationary engines (com.)—J. M. Napier. Bottle labels.—R. S. Norris. Apparatus for cutting or getting coal and other substances in mines or quarries.

On January 10th.—133 to 148.—F. J. Drechsler. Winnowing machines.—G. Walker. Curtain hooks and clips for suspending or securing hangings, garments' hats, and various other articles. J. D. Derry. Holders for lamps and candles.—J. Radford. Safety valves.—M. Billings and G. K. Billings. Steam generators.—P. Jensen. Modes of and means and materials for the manufacture of vats, gas-holders, and other vessels (com.)—J. Brennan. Apparatus adapted for facilitating the teaching of arithmetic in schools.—E. Wright. Sewing and other needle machines (Complete specification).—C. W. Corpe. Construction of concrete buildings.—J. H. Cohrs. Railway couplings.—J. Foster and W. Whitaker. Apparatus for cleaning and smoothing the "dents" of reeds of looms for weaving.—C. Avery. Teeth gearing and lubricating bearings applicable to horse-power engines and other purposes.—J. Sikes, T. S. Bateman, and J. Mellard. Machinery for rolling metals.—E. Lord. Apparatus for drying yarn in the processes of sizing, dressing, bleaching, and dyeing.—A. A. Deiss. Extraction of quinine from bark.—C. M. Talcott. Manufacture of screws (com.)

On January 12th.—149 to 163.—G. K. and G. Seydeler. Measuring the distances run over by wheeled vehicles.—D. McMillan. Appliances for cleaning the driving surfaces of machinery belts.—J. S. Crossland. Economising fuel and consuming smoke in stationary, marine, or locomotive steam boiler and other furnaces.—C. Mohr. Riveting the joints and seams of deed and other boxes, travelling trunks, coal vases, and similar articles.—W. Foulis. Apparatus for charging retorts.—J. S. Cockings. Snap or portable connectors for harness and other useful purposes where a metallic portable connector may be required (com.)—J. Shaw and J. Shaw. Hydraulic hoisting apparatus.—J. C. Mewburn. Textile fabric (com.)—E. T. Hughes. Safety apparatus applicable to cages used in the shafts of mines and hoists (com.)—T. Ward. Railway brakes.—W. Russell. Apparatus for the manufacture of Ayrshire bonnets.—A. E. Schmersahl. Treating sewage water and other foul liquids.—J. G. N. Alleyne, Bart. Apparatus for puddling iron.—J. Leeuwenstein. Safety screws for every kind of packing.—H. Deacon. Treatment of impregnated porous substances employed for effecting chemical decomposition of certain gases at an elevated temperature.

On January 13th.—164 to 179.—G. Eyre. Convertible school desks and seats.—R. B. Newall and H. Bowman. Method of [illegible] muriatic acid gas and other fumes.—P. Wilson. Double-drill plough.—C. E. Hearson. Argand burners.—C. D. Abel. Electric tell-tales for pressure gauges (com.)—J. Norman. Apparatus for clipping horses and other animals.—S. Turnbull. [illegible].—A. R. Donisthorpe, G. E. Donisthorpe, G. White, and J. Tom. Manufacture of yarns from wool and such like fibrous substances.—J. E. Ellis and E. Redgate. Machinery for treating hides and skins.—W. Black and D. Hill. Manufacture of soda in revolving furnaces.—J. Lake. Apparatus for regulating the draught in the internal flues of steam generators.—W. Beverley. Life buoys.—J. Scaife. Material for use as packing for the piston rods of steam engines, pumps, and like uses, and method for packing the same.—J. Bullough. Machinery or apparatus for sizing and drying yarn.—J. Howard and E. T. Bousfield. Steam cultivating machinery.—F. J. Bird. Manufacture of mordant applicable to the dyeing of cotton and union goods.

On January 14th.—180 to 191.—J. W. Lewis and G. Wool. Stoves or ranges for heating, drying, cooking and baking.—E. Cole. Crushing and reducing to impalpable powder baryta, cocoa, refined sugar, and similar substances, both vegetable and mineral.—D. Imhoff. Automatic musical instruments.—W. J. Burgess and C. T. Burgess. Reaping and mowing machines.—C. D. Abel. Dressing and finishing woollen cloths and other like fabrics, and apparatus therefor (com.) (Complete specification). A. Pourcel è Destruction of insects by the aid of steam alone or mixed with chemical vapours to be applied to agriculture.—D. Eastwood. Looms for weaving.—W. Kirk. Machinery or apparatus to be employed in the manufacture of "tips" for shuttles for weaving.—J. H. Smith. Self-acting mules.—C. Heaton. Emery or other grinding machines, parts of which are also applicable to other machinery.—F. Sival. Manufacture of lace.—E. Nugent. Machinery for the manufacture of screws and screw nails. (Complete specification).

On January 15th.—192 to 205.—D. Stewart. Constructions of clips or holders and their chains for cloth-stretching and finishing machines.—R. Smith, G. W. Stephenson, and J. Vere. Treble-purchase capstan for fishing and other vessels.—E. Jones. Metallic cartridge cases W. E. Teale. Lamps.—T. Moison. Machines for drying tissues, felts, threads, and textile materials, and for destroying at the same time, if necessary, any vegetable matter which may be contained in the fibrous animal material.—H. Yates. Ornamentation of lace and other textile fabrics.—T. Taylor. Apparatus for grinding or surfacing metal.—H. V. Dyk. Dressing and travelling bags, stationery and other similar cases.—G. Arnbold. Treatment of substances containing alumina, so as to render them more suitable for the production of aluminous compounds.—C. Wood. Granulating machines.—J. L. Clark and J. Standfield. Floating docks and pontoons.—W. D. Hooker. Direct-acting steam engines, also including pumps, said engine being applicable for driving pumps, steam hammers, and other machinery, in which a direct action is required. (Complete specification).—J. Clark. Waterproof garments, and the production of materials from which such garments are made.—A. V. Newton. Apparatus for filtering, rectifying, or clarifying liquids and gases (com.)

On January 16th.—206 to 220.—C. J. Ball. Drills for boring holes.—P. Huerne. Self-cleaning water filter, &c.—A. M. Clark. Lamp-black (com.)—C. de Fever. Machine for sewing and planting.—J. Atkins. Ornamental metallic tubing. F. H. Smith, M.D. Tape plaisters or bandages, and mounting same upon reels or holders.—W. R. Lake. Peat fuel (com.)—C. Bailer. Mats (com.)—J. H. Johnson. Combustible compositions, and their mode of application for signalling and illuminating purposes (com.)—J. H. Johnson. Machinery for making wooden rollers employed for spinning, &c.—J. S. C. Heywood. Compositions to be applied to the surfaces of ships and to other surfaces for the purpose of protecting them, and treatment of such.—G. Lowry. Governors for steam and other motive-power engines.—[illegible] Ornamental fabrics made on lace machines.—J. T. Griffin. Wrenches for turning pipes, bars, &c. (com.)—A. Brown. Converting steel bars, wrought iron scrap and rails, &c., into steel or metal having the properties of steel [illegible].

On January 17th.—221 to 233.—[illegible] Horse-shoes to prevent accidents.—J. Whitley. Holding or [illegible] [illegible] and [illegible].—[illegible] Hydraulic motive-power engines.—G. Smith. Bichromate of potash.—L. J. Todd. Tramway locomotives and boilers.—J. Lamont. Water-closets and service cisterns.—A. Abrahams. Mode of producing the evaporation of perfumery and other fluids.—E. Butterworth. Machinery for preparing, spinning, doubling, winding, and reeling cotton, and other fibrous substances.—W. Hartmann and G. H. J. Hartmann. Apparatus for locking and unlocking railway carriage doors.—S. T. Du ton. Railway facing points, and working and securing same.—Rev. G. H. Forbes. Purification of gas and manufacture of artificial fuel.—Rev. G. H. Forbes. Purification of gas.—W. R. Lake. Ventilating and warming apparatus (com.)

On January 19th.—234 to 249.—J. Macintosh. Cigarettes.—T. T. Blair. Composition or coating bottoms of ships and submerged structures.—T. Robinson. Caustic soda boiling or concentrator.—C. A. Lippincott. Manufacture of condensed milk (com.)—J. Mathieson. Mode of protecting torpedoes from premature explosion.—J. Broadfoot. Pumps.—M. Macmillan, sen. Finishing or treating woven fabrics.—J. Miller. Treating animal size for the obtainment of glue and other products.—W. E. Gedge. Gas burners with lateral and covered jets (com.)—J. Siddall and F. Gutteridge. Oil lamps.—W. Whiteley and G. Harling. Looms for weaving.—R. Van de Weerd. Apparatus for producing motive power, and for driving mechanism.—E. P. H. Vaughan. Generating inflammable gas by the carburisation of atmospheric air (com.)—J. H. Johnson. Shoe tips (com.) (Complete specification.)—W. Easton and F. Tidswell. Machinery for moulding bricks and other blocks.—G. C. Pattison. Fog signals and alarm bells to be used on a vessel or at lighthouses, shoals, or other places.

On January 20th.—250 to 255.—J. H. Smith. Sewing machines.—A. Abrahams. Gas and other lamps.—G. Lewis and A. Lewis. Trucks or barrows more especially intended for carrying, elevating, emptying, and filling sacks, loading them into waggons or carts or other vehicles, and other like operations.—A. M. Clark. Electric telegraph apparatus, and alphabetical symbols for use in transmitting telegraphic messages (com.)—M. H. Synge. Apparatus for deodorizing and discharging fluids, and for trapping sinks, drainpipes, and tanks.—M. H. Synge. Apparatus for filtering and purifying the drainage of houses and streets.

On January 21st.—256 to 266.—J. B. Stearns. Electric telegraph apparatus (partly com.)—T. Fox. Spring mattress.—J. F. Harvey. Umbrellas, parasols, and sunshades.—E. C. Kinder and J. T. Kinder. Construction of combined cabinet and automaton smoking or fumigating apparatus.—J. Strachan. Cheques and similar documents for banking and other purposes.—W. R. Lake. Lamps (com.)—J. E. T. Woods. Steam and other boilers.—H. Lomax and G. F. Bradbury. Sewing machines.—A. Maw Metal moulds or dies used in the manufacture of earthenware or china from clay in the powdered state by means of compression.—F. H. C. Monckton. Magnetic engines.—R. C. Molloy and D. G. Fitzgerald. White lead.

On January 22nd.—267 to 282.—J. Merrill. Pinch bars for removing railway waggons, carriages, &c.—H. Greaves. Glass letters and figures.—A. Ford. [illegible] cotton waste.—W. T. Widdeman. [illegible].—T. Griffin. Coupling [illegible] [illegible] Motive-power machines.—[illegible] Wood-working machinery (com.)—[illegible] low, J. Roebuck, and J. [illegible] points.—W. Thompson. [illegible] moulding [illegible] Thompson. Stoppers or [illegible] for bottles, jars, &c.—A. Tylor and J. F. Tylor. Apparatus for containing [illegible] [illegible] W. R. Lake. [illegible] metal rails [illegible] and other like [illegible] (com.)—[illegible] Signalling or [illegible] [illegible] [illegible].

(Continued on page 73.)

Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

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JOURNAL OF THE INVENTORS' INSTITUTE.

MAY 1, 1874.

PREVENTION OF ADULTERATION.

No. II.

It is curious to note the various decisions given by the magistrates. A case brought before Mr. Partridge in October last, in which a mustard admixture was sold bearing a label, "This is an admixture in which no injurious ingredient has been used. 35 and 36 Vict., c. 74, s. 8," was held by him to be sufficient, and he accordingly dismissed the summons. This appears to us, as far as possible to meet the requirements of the Act, but similar cases have occurred where the sellers have been fined. A summons heard before Mr. D'Eyncourt was dismissed, as he observed, that "the adulteration was sanctioned by long custom." A more important case came before the Southwark Police Court, in which the seller pleaded guilty. Mr. Benson, however, observed that it was "difficult to get at the parties who were morally guilty, and instructed that proceedings should be taken against the manufacturers." The case was, however, afterwards disposed of by the seller being fined twenty shillings. Many more cases might be mentioned presenting anomalous decisions. That the Act must be amended is certain, for neither manufacturers nor retail dealers will submit to such a gross injustice to trade.

Tea is an article largely adulterated in China, and has recently occasioned several prosecutions, yet the Act has no clause to protect the innocent tradesmen and punish the real culprits. Surely this is a great defect in legislation—the more so, when we consider that tea duty is an important item in the revenue. Perhaps the Grocers' Company of London could do something herein.

The desire of the majority of the analysts who are enforcing the Act, is, that no admixture shall be allowed. But the result of the various trade meetings, is a petition in which is embodied a desire that the names of all ingredients shall be clearly printed on all articles sold, when admitted to be admixtures. A more stringent course might, however, be adopted, which would be that the percentage of mustard, flour, or cocoa should be stated on all admixtures in the following manner:—"This article contains seventy per cent. of mustard," flour, or cocoa as the case may be. The purchaser would then be in a position to judge of the value of the article sold. Though we question whether the exigencies of petty retail trade, and the circumstances of large numbers of people allow of excessive rigidity being exercised in these matters. Food must be had in sufficient quantity; and a very little of the very best will not suffice to meet the wants of the many; and to say that people can mix the inferior ingredients for themselves, is [illegible] of that [illegible] kind of talk which our [illegible] [illegible] as convincing to themselves when [illegible] [illegible] the transactions of people in different spheres of life to that in which they move. Moreover, a prevention system rigorously applied would militate against the introduction of inventions for new food compounds, seeing that, as we have already intimated, innocuous, even beneficial, admixing is a finable offence.

But to return to mustard: the innumerable names given to the various qualities of mustard which we have tested must often delude the public, and give an opportunity to an unscrupulous tradesman to palm off a lower quality of mustard for that of the best qualities called genuine, and double superfine. If manufacturers could only see this, and issue but three, or perhaps, two qualities of mustard, we are convinced it would be greatly to their advantage.

The firm of Messrs. Keen, Robinson, Bellville and Co., whose manufactory is the oldest and largest in the City of London, exports tons to America and the Colonies, besides which, it finds a large consumption at home; and without attempting to disparage the productions of other manufacturers, we can confidentially say that no better article can be obtained than those issued by that firm in square cans.

A calm consideration of the actual position of affairs convinces us that the suppression of adulteration should not be ridden too hard, for we cannot, with any certainty, deal with first offences unless of a gross and unmistakeable character, upon analysis only, since, if cases are well fought, we may often have similar results to what occurred not long ago with regard to bread, when two chemists of the highest eminence, and as we from well grounded knowledge of them, would affirm of the highest talent and integrity, Dr. T. Redword and Dr. Hardwicke, were opposed by another chemist of eminence, Mr. Wanklyn, in such form and manner that the whole proceedings served only to point the moral "when doctors disagree who shall decide;" and to force upon us this self-evident proposition that a matter which produces diametrically opposite opinions from men of scientific eminence cannot be dealt with as a matter of certainty by our magistrates. Surely to mulct an ignorant petty trader, when not the producer, for dealing in articles which first-rate scientific men do not concur in asserting to be adulterated, must, if we have nothing beyond analysis to guide, be absurdly cruel.

The truth is we have set about the task of suppressing adulteration without having secured a sufficiently certain basis for our operations, and well devised machinery for giving effect to them. To start with such a theory as that upon which the present adulteration Act proceeds, namely, no admixture of any kind, may be simple enough. We consider it simple in more senses than one; and if the law is to maintain the character of being just, equal, and reasonable, this Act must be carefully reconsidered after due consultation with commercial men, and men of science. And convictions under the Act must not be left to the mere *ipse dixit* of a magistrate, prompted by analysts whose business is held to be to secure convictions, as would appear to be the case, as anyone will perceive who carefully notes what is from time to time stated in the public prints with regard to these analyists; some of whom are said not to do enough in the way of procuring the punishment of adulterators—a pretty clear hint that they are more advocates on the side of prosecution.

One thing appears to us almost indispensable in order to secure the satisfactory working of the Act, and that is, the magistrate should be assisted by a scientific assessor, with whom he should advise on the scientific aspect of the case presented for adjudication; such assessor to be open to be objected to by either side, in order, if possible, to secure that impartial and reliable men only be placed in that position.

Reviews.

STUDY OF ORGANIC CHEMISTRY.

"Introduction to the Study of Organic Chemistry.—The Chemistry of Carbon and its Compounds." By HENRY E. ARMSTRONG, Ph.D., F.C.S., Professor of Chemistry in the London Institution. London: Longman, Green, and Co., 1874.

THE present work is another of that admirable series of text-books, published by Messrs. Longman, which we have before had occasion to speak of in terms of approval, and this one is certainly one of the best works of its kind. The author, so far as the limit of the book will allow, has gone into his subject with great exactness. Thus, the first part of the work deals with the method employed in ascertaining the composition of carbon compounds, and representation of such compounds by empirical formula, and by formula which not only express their composition, but also to a certain extent picture their nature. After a short description of the action of various reagents on carbon compounds, the compounds of carbon with oxygen, with sulphur and with nitrogen, are considered; and next is described the great family of hydro-carbons, and then the remaining compounds of carbon are considered in the order of their relation to the hydro-carbons, which are regarded as forming the parent series.

We cordially recommend this work to all searchers after scientific knowledge, and we have no doubt that benefit will be reaped by its careful study.

PRINCIPLES OF SCIENCE.

"The Principles of Science A Treatise on Logic and Scientific Method." By W. STANLEY JEVONS, M.A. London Macmillan and Co.

THIS is a work that ought to be studied by all who are not content with a superficial view of science, or of life around us. It aims, according to the author, at direct opposition to the philosophy of Auguste Comte, supplanting it by one that, as he says, will not deny the existence of things because they cannot be weighed and measured. It will rather lead us to believe that the wonders and subtleties of possible existence surpass all that our mental powers allow us clearly to perceive. The study of logical and mathematical forms has seemed to convince him that even space itself is no requisite condition of conceivable existence. Doubtless many persons will not agree with this philosophy; but as the way in which Professor Jevons handles the subject is both able and ingenious, it will therefore be read with interest by all who are inclined to the study of speculative philosophy.

STEEP GRADIENTS ON RAILWAYS.

"A Treatise on an Improved Method for Overcoming Steep Gradients on Railways, whereby any ordinary locomotive, capable of hauling a given load up a gradient of 1 in 80, can take the same up 1 in 8." By HENRY HANDYSIDE, late Assistant Provincial Engineer to the Government of Nelson, New Zealand. London: E and F N. Spon, 48, Charing-cross. New York: 446, Broome-street. 1874.

THIS pamphlet in an able manner treats of a subject now one of the most important of the present day. Whilst dealing with the question generally, the author introduces his own plans in the following terms.—

The general details of the new system may be understood from the following description, and relate principally to one arrangement of parts, to be applied to almost any ordinary construction of locomotive and railway carriage or waggon, whereby the safe and easy ascent of trains up steep gradients is accomplished, and their passage round sharp curves is facilitated.

According to the new system the locomotive engine is coupled to the train by a steel chain, which is wound round a drum mounted in the framing of the engine.

The axis or shaft of this drum works horizontally in bearings fixed in the main framing of the engine, and is rotated, direct or with more advantage by gearing, from a separate pair of cylinders, distinct from the usual cylinders which drive the locomotive.

The drum need not exceed 2 feet in width, and its barrel 1 foot in diameter, with an outside diameter for the cheeks of 3 feet: this size will accommodate an ample length of steel chain to fulfil all the requirements of the system.

The chain to be of about ¾inch diameter, round steel, slightly tempered, and the required length need not exceed half a ton.

On each side of the engine framing, and also on each side of one or more carriages or waggons of the train, there are suspended one or more self-acting gripping struts, which, when let down on the rails by the driver or other person in charge of the train, will firmly grip the sides of the rails and hold the engine or train stationary.

The gripping portion of these struts are made of steel, having their inner surfaces hardened and roughened, so that the possibility of slipping is entirely obviated, and as the *sides* of the rails are thus being grasped by roughened surfaces of hardened steel, the *top* of the rail will not sustain any injury.

On arriving at the foot of a steep incline, the engineer will release the hauling-drum, and may without stopping the engine run it up the gradient to any desired distance.

The driver having released the struts, they come into contact with the rails, and on the engine being stopped and attempting the least retrograde motion, they firmly grasp the rails, and maintain the engine in its place.

The hauling-drum is now started, and the chain draws the train close up to the engine.

The struts on the train are not allowed to come into action, and firmly holds the train in its place or these struts may have been released before commencing the ascent of the incline, by which means all possibility of accident from the breaking of the chain, or other cause, is entirely prevented.

This automatic action of the struts must recommend itself as a great advantage when it is considered that at present the usual break appliances are entirely dependant on the vigilance and presence of mind of the person in charge of the train.

To prevent danger of over-winding, a simple automatic arrangement is attached to the engine, by which the steam is cut off from the cylinders which drive the hauling-drum the moment the train touches the engine.

The operation which has now been described will be repeated as often as required, until the whole of the gradient has been surmounted

The author would particularly call attention to this feature of his system, that no particular length of gradient has any influence on its success, neither is it *essential* that the length of the chain should bear any relative proportion to the length of the gradient.

On the level sections, or on comparatively light gradients, the locomotive acts precisely as an ordinary locomotive engine.

It is obvious that this arrangement of hauling drum and separate winding-engine will also be found most serviceable in facilitating the hauling of heavy trains by light locomotives round sharp curves.

In order to prevent exposure and consequent injury to the tubes and fire box roof, by reason of the displacement of the water-level when ascending or descending steep inclines, there are provided two steam domes, or chambers, on the top of the boiler near the end thereof, and these are connected by an equalising pipe. The steam for supplying the cylinders of the engine and those of the winding-drum is taken from the domes in the usual manner.

Having thus fully described the principles of the new system, and the means to be employed for carrying it out, Mr. Handyside proceeds to explain all the numerous advantages claimed for it. These we hope Mr. Handyside will at some not distant day enable us to illustrate more fully than we can at present do.

SEWAGE FARMS.

"Will a Sewage Farm Pay? or, Theory Combined with Practice." By Lieut.-Colonel ALFRED S. JONES, V.C., (late 9th Lancers) passed Indian Examination in Surveying and Civil Engineering and Graduate of the Staff College, Sandhurst. London: Longmans, Green, and Co. 1874.

THIS pamphlet is a noteworthy contribution to our literature on sanitary subjects, aiming, as it does, at affording some aid towards a satisfactory solution of the following increasingly important questions, viz.:—1. How can we protect the inhabitants of large towns and their country neighbours from the evil effects of stagnant sewage? 2. How may we augment the supply of fresh meat, milk, and butter, which even free trade has failed to provide in sufficient proportion to our rapidly increasing population?

No pretension is made to the merit of any new discovery or specific for the long debated social evils referred to in the above questions, the writer indulging in the hope that simple attention and observance of the laws of nature may be trusted to accomplish much that is desirable in both directions

It commences by stating: that amidst the numerous schemes for purifying town sewage, by precipitating agencies, which have cropped up from time to time, the old natural course of irrigation has always held its own, while the former dropped out of notice one by one mainly because, however clear the effluent water from precipitating works may look to the eye, it has really left behind it only those solid impurities which were mechanically suspended in the sewage, and flows out of the precipitating tanks with its burden of chemically dissolved impurities as great or even greater than that carried through the sewers to the precipitating tanks.

These schemes had moreover the disadvantage of being very expensive, and regard for economy constantly led their managers to reduce the proportion of precipitating agents to volume of sewage below that just proportion which would give the maximum effect in clarifying the sewage; but within the last two years General Scott, R.E., has brought forward his cement-making process which more modestly professes clarification of sewage rather than purification which used to be claimed as a result of precipitation by the enthusiasts who introduced the other schemes.

If General Scott can obtain a good market for all the cement he can produce there is every reason to hope that the process may answer his anticipation of effectually clarifying sewage, and thereby facilitate further purification by a smaller area of land than would be required for that purpose if raw instead of clarified sewage were poured upon the land; his success will depend upon the cement market, because considerations of economy must creep in to reduce his proportion of lime unless the sale of cement shall recoup the cost of lime and labour consumed in its manufacture.

If we discard the precipitating schemes, which in their latest form aim only at clarification, leaving purification to be accomplished by the only two agencies (earth and vegetable life) which have ever really accomplished the end in view, and turn to consider irrigation, we shall find that exaggerated notions of the pecuniary results to be expected from sewage farms have in many cases led to extreme disappointment and extravagant demands on the resources of Town Councils.

The success in a sanitary point of view of well-managed sewage farms, whether on an extensive area of land or where large volumes of sewage are administered upon small ones for short periods with intermitting terms of rest, as in the case of intermit-

tent filtration at Merthyr Tydvil, appears to be generally admitted, but the practical question how far the produce of such farms will repay the heavy charges for rent, labour, and necessary capital has long appeared to be the pressing and all important consideration for the following reasons, viz. :—1. Because if a farmer can be induced to learn as a fact that every drop of town sewage he can put upon his land will return as money into his pocket, the management of the farm may be left to him with a certainty that the sanitary object of purification will follow as a necessary consequence from the operation of the love of self-interest, a common passion of the human race far more likely to be effective than legal penalties, on the farmer, or a sense of duty on the part of Town Councils, committees or their agents, to whose hands sewage farms have for the most part been committed. 2. Because Town Councils and farmers entertain a natural suspicion of scientific authorities who make demands upon their credulity without offering ocular demonstrations to sustain their theories.

Further on the writer alludes to certain sewage experiences of his with regard to the town of Wrexham, and from this he derives one great lesson: after two years' practical study of the sewage question, which, he says, appears to him to be one of general interest to all towns, he takes it as pointing unmistakably to the necessity of adopting in all cases what is called the "separate system," recommended some years ago by Mr. Menzies, deputy-ranger of Windsor Forest, &c., adopted at the camp at Aldershot, and promised by the War Department to be carried out as regards the new depôt centre barracks about to be erected at Wrexham, which will set an example which he trusts will be copied ere long by the municipal authorities for the whole town.

[The "seperate system" consists in simply providing a clear course for all rain-water from roofs, streets, &c., by direct lines above or below ground to the natural water-courses, instead of leading it by street gullies into the sewers and burdening the latter with the double duty of carrying away both sewage and rainfall.]

It is evident that if sewers were constructed of capacity equal to the performance of this double duty, their construction would be far more expensive than if made of size calculated for the single purpose of conveying sewage, and they would have the disadvantage of reducing the rate of flow in dry weather where their gradients are at all flat, and thus allowing poisonous deposits of filth to collect and ferment immediately below the streets in all parts of a thickly populated neighbourhood; whereas if made of a diameter calculated for the sewage which is governed by the artificial water supply of the town, their contents (more especially if the section of sewer were egg-shaped) would be at all times in motion and reach the land upon which they have to be utilised in so fresh a condition that they would be purified thereon before any fermentation could set in to disperse those noxious gases which some hours' stagnation inevitably involve to the loss of the crops and hazard of animal health.

Practically, therefore sewers are never made of capacity equal to the double duty thrown upon them in wet weather, and to avoid their standing full on these occasions overflows are provided as above described.

The occasional expense of "flushing" sewers is sometimes used as an argument in favour of the system in which that operation is often administered with a vengeance by natural means rendering artificial flushing unnecessary; but if the sewers are properly constructed, the regular water supply is sufficient to keep everything moving, and even if flushing were necessary the artificial operation, being under control, would create no foul overflow or inconvenience to any-one.

Colonel Jones (the writer) has, it appears, a sewage farm near Wrexham, as to which he gives much detailed information, accounts being stated in an appendix. These shew a fair profit from his farming. He concludes that unremitting attention to crops, sewage, and markets is the secret of success in making a sewage farm pay, and he adds, it seems to me that local boards have usually failed as sewage farmers from the want of fixity of purpose common to such bodies; they have involved themselves in lavish expenditure at one time, and recoiled into parsimony at another, forgetting that if the labour of cultivation, and "exploitation" of the resources of the farm is not constant, weeds or unsaleable crops must sooner or later be removed from the soil unless the farm is to become a sewage marsh instead of a garden. The labour, in short, must be employed wherever sewage is put upon land and the choice lies between productive and unproductive labour. As to the poisoning of milk by sewage farming, Colonel Jones says:—

I had but just begun to send milk for sale in the town of Wrexham when Dr. Smee made the unfortunate mistake which was so fully corrected by testimony on all sides in favour of sewage milk, and whether it was this controversy or the merits of Hafod-y-wern milk which operated as an advertisement I do not know, but the fact is that the demand has increased to such an extent that it has been difficult to make the supply keep pace with it. I have now twenty-five cows, and send two carts every morning and one at night to sell milk at 3d. per quart.

The city of Edinburgh has been supplied for a century or more with milk from cows fed almost exclusively on sewage grass, and it always appeared to me that stronger evidence than that produced by Dr. Smee would be required to refute the testimony of the medical officer of health for that city, give in the report of the Royal Commission on pollution of rivers, viz:—

"The cows in Edinburgh are chiefly fed with grass from the Craigentinny meadows.

"I have failed to detect any bad effects from the use of such grass. All the cattle which have been fed on this sewage-grown grass find their way to our slaughter houses where they are examined by the inspectors and myself. So far as my observation goes the use of sewage grass for the food of animals is unobjectiquable.

"If there had been anything in the idea that sewage grass would lead indirectly to entozoic disease it has had plenty of time to develop itself; and Edinburgh is not only the seat of a great medical school, but medical observation is carried to the highest point in Edinburgh, so that it could not fail of being detected."

In a sanitary point of view my experience only confirms that of others that there are few more healthy residences than a well managed sewage farm, or more unhealthy ones than any neighbourhood, whether town or country, in which sewage is allowed to ferment in a stagnant condition.

The motto of all who deal with sewage should be that of the policeman in a crowd, viz.: "Move on": for nature's great law demands that all dead and decaying matter shall as speedily as possible produce new life and be built up into fresh forms of vegetable and animal tissue. If man, the intelligent police who should facilitate the operation of this law, neglects his duty, the majesty of nature will assert itself through the process of fermentation to loosen the cohesion of sewage atoms in order that they may reach the vegetable life for which they are destined in the form of gas if they cannot do so as a liquid; and let us remember that the law of diffusion of gases will then operate without regard to the sufferings of animals who may chance to breathe an atmosphere more suited to the other kingdom of nature than to their own.

DICTIONARY OF LANGUAGES.

"The Treasury of Languages; a Rudimentary Dictionary of Universal Philology." Hall and Co., London.

This is a work which will be found of great utility to every person taking an interest in philology or literary pursuits. It contains an alphabetical list of all known languages with the received classification, and accompanied by a synopsis of grammars, vocabularies, &c.

This compilation is stated to be the work of a literary amateur, and although not free from error, will yet be found an industrious and faithful repertory of known facts, which have never before been presented to English readers in a compendious, accessible, and connected form.

THE YEAR-BOOK OF FACTS.

"The Year Book of Facts in Science and Art, exhibiting the most Important Discoveries and Improvements of the Past Year in Mechanics and the Useful Arts; General Science, Electricity, Chemistry, Zoology and Botany, Geology and Mineralogy, Meteorology and Astronomy" By John Timbs. London: Lockwood and Co. 1874.

Mr. Timbs' Year-Book is so well-known and its value so widely acknowledged, that when we say that the volume for the present year is not less compendious as to interesting and instructive scientific facts of the past year than its predecessors have been for previous years, we say only what is the fact as to this Year-Book of Facts. Those of our readers who may not have possessed themselves of a copy, we recommend to do so. This annual work, though highly useful to all intellectuals, should above all be in the hands of every inventor.

POETRY.

"Lord Harrie and Leila;" a Romance of the Isle of Wight, and other Poems. By Henry George Hellon. London. Provost and Co., 36, Henrietta-street, Covent Garden, W.C.

Second Notice.

As the germ sets the philosopher thinking, so nature is the source of the poet's inspiration. To confirm this we need only refer to the poetry of the ancients, to Chaucer, the great father of English poetry, or our more recent poets who shone during the early part of this century. In Percy's reliques, the most valuable collection in our language, we have many proofs in support of this.

What is poetry? is a question often asked, and few there are who are prepared to answer it. Were poetry better understood, much that now passes for such would never have seen the light. The host of imitators now springing up are innumerable—would that these would only learn that to be a poet is to have the power of invention.

Poetry, said Shelley,

> Is the record of the best—and happiest moments
> Of the best—and happiest minds.

It is the utterance of a passion for truth, love, and beauty—akin to music and painting. In the imagination it brings to the mind's eye the loveliest form of all things in nature, and in its fancy it plays as the sun-light on the clouds—and, more than all, "is a joy for ever."

There is much in these poems well worth the perusal of those who appreciate poetry; the vein of melody throughout is fine. The stanza which appears best to suit Mr. Hellon, and of which he is a thorough master, is the octosyllabic, thus form, when written in lyric iambic quatrain, is undoubtedly the best for narrative poetry. On page 42 we meet with the following stanza, intended to convey the idea of the early sunrise:—

> The dew o'er nature woke to sigh,
> And waft a blessing to the sky.

And on page 97, canto 6:—

Fairest of valleys, smile away!
Thy charms woo many a step to stay,
Thy village, nestled 'neath the shade
Of shrubland, grove, and sunny glade;
Thy myrtles, vines and blooming flow'rs
O'er running love's celestial bow'rs;
Thy river gliding on to greet
Each cottage home and fairy seat;
Thy winding hill bedecked with trees,
Which answer to the passing breeze.

The description of Leila, as she listens to the song of the nightingale, with

Her tresses waving in the wind

is very charming.

It is difficult in this stanza to change from gay to grave, but we find Mr. Hellon equal to the task. On page 79 we are reminded of the mossy walls of the antique church of Brading, once the scene of the revelries of the monks of Ina, which—

Awake the past, and each grey stone
Peers in the moonlight sadly lone;
And lesson like, as if 'twould preach,
We list its solitary speech.

It rarely falls to us to read poems with such a variety of stanza. Poetry, being an inspiration, must necessarily be written in the verse that such inspiration is received. The poem of "Lord Harrie and Leila" opens with the octovarima, but concludes with the octosyllabic. Of the sonnets we cannot speak too highly. Perhaps no one is a greater authority on the sonnet than Leigh Hunt, and no one showed a greater love for it than Keats. It is strange that such a genius as Shakespeare should have died in the belief that his sonnets were the only immortals of his writings; still stranger is it that he did not know how to write a sonnet, for those extant are very faulty; they are now rarely read. Indeed, even his warmest admirers seem scarcely aware of their existence. The sonnet is of Italian origin, of which the following is a specimen from Mr. Hellon's poems, page 272:—

To Morning.

Thy blush, Aurora, is my soul's delight!
I love thy glow, awak'ning me from sleep,
And join in Nature's melody to keep
Thy sacred day—and climb the hilly height
To sate in shades which speak thy sov'reign might.
If there's on earth a happiness I seek
More dear than death—O! 'tis my soul to steep
In *faery* bow'rs, and watch thy wingèd flight.
E'en from my cradle, ere I knew the grief
That wrings the heart—ere this sad life is run—
My soul in adoration did unsheaf
Her tiny wings to revel in thy sun!
And should they reach threescore, or be but brief,
Still will I love thee as when they begun.

"Arlou Grange and a Christmas Legend." By William Alfred Gibbs. Author of "The Story of a Life," "Harold Erle," &c., &c. Artist's edition. London: Provost and Co., 36, Henrietta-street, Covent-Garden.

Mr. Gibbs has here presented us with another effort of his muse, which, for the present, we must be content with commending to our readers as a work of considerable poetical merit, of high-tone morals, and narrating a pleasing story. We shall probably soon find an opportunity for a fuller notice of it.

BELL'S SYSTEM OF CONSTRUCTION OF IRON WAR SHIPS AND FORT FACES.

The following is the substance of the paper read by Mr. R. Bell, C.E., F.R.I.B.A., with the discussion that ensued thereon, at the meeting of the Inventors' Institute on 16th April, 1874:—I propose (said Mr. Bell) to bring under your notice this evening the following description of a mode of constructing iron armoured vessels of war and the fronts of forts, capable of resisting artillery of the heaviest description; armour, the power of which can be increased to any extent that it will be possible to increase the power of artillery, and in which teak or oak are entirely discarded. That is to say, I construct the ribs and frame similarly to the present mode, and I build up the bottom and sides by stringing a series of iron strakes horizontally, one upon another, interlacing them like the planking of a wooden ship. The surface and subface of each strake have double parallel grooves or sinkings for their whole length, making them somewhat in the shape of a railway bar before they are placed in position; and, to break the direct passage of the shot, a smaller bar or strake made with grooves or sinkings in all respects similar to, and to correspond with, those of the larger strakes, is introduced, and the projections of the smaller strakes, when brought together with those of the larger, form a system of cells the use whereof is explained hereafter. The bars, large and small, are strung together over wooden perpendicular templates, with a layer of tarred felt on the inside between every bar, and another thickness of mahogany in the outside joint. When, say, five or six of these strakes, large and small, have been laid, a collar is inserted embracing the inner perpendicular template, and also the rib of the ship, acting like, and instead of, a trenail. One of the wooden templates is then withdrawn, and is replaced by one of red-hot iron, passed down through the same orifice, and keyed at the bottom, and at the same time the collar or trenail is keyed to the rib of the ship; then the remaining templates are withdrawn and replaced in the same manner, and keyed in the same way. It is not necessary that these templates should be one continuous length, they may be of any convenient length.

It is obvious that these strakes may be made any width that may be desirable; at least as wide, if necessary, as the plates now in use, and the perpendicular compressors or cramps can be also any number or size; and, with the aid of the felt and mahogany, will be impervious both to water or shot.

Thus it is seen that no wood, except it be desirable, is used in my construction, by which a great saving is made. I have never been able to discover any logical reason for its use. If iron be better than wood for external defence it is equally so for backing; a cubic foot of each material, oak, teak, and iron weighs consecutively as follows:—oak, 45,438 lbs.; teak, 42,530; and iron, 480 lbs., consequently iron has 10,582, or $10\frac{1}{2}$ times the solidity of oak, and 11,288 or more than $11\frac{1}{4}$ times the solidity of teak. And with respect to tenacity iron has 7 and 8 times the tenacity of oak and teak respectively; therefore, for all reasons the application of wood is a great mistake.

The strength of a ship thus constructed as I propose lies in the direction of the force intended to be applied, and it is the only mode known at the present of constructing iron capable of offering opposition to the challenge of Sir William Armstrong or Sir Joseph Whitworth with effect, and it will continue to do so whatsoever may be the power of their artillery; ramming the stem and bows acquire all the force, and in case of impetus of the armour in the rear even as far as the stern without any unequal strain on the sides, and all weight that would be given by additional thickness adds to that power, whilst by the present mode of iron plating, every additional thickness of iron by so much overloads and weakens the side of the ship, and the tendency of the rear plates, which are only screwed on, being to thrust off those on the bows, there might be great danger that one of the effects of concussion, if of an effectual kind, would be to send the ship and her crew to the bottom.

Again, the strength of my mode of construction gives the power of building any increased width of beam, and obtaining a corresponding decreased draught of water.

Torpedoes may be exploded against such a vessel in vain, and it would resist the running on many a shoal with impunity.

The purpose of the cells formed in the iron planking is to overcome objections to solid iron plating, namely, now that part of the plate struck by the shot, being first compressed by the impact to the extent of its compressibility, the outer and inner faces of the plate are then acted on simultaneously, and as the iron cannot expand laterally, because of the density of the surrounding iron, its resistance is confined to the same area of plate as first received the impact, and the fibres of the iron are cut with comparative facility and driven inward in the direction of the line of fire. But the cells cause the shot to create increasing resistance to itself, as the iron with which it comes in contact is enabled, when driven to expand, laterally thus filling in the cells that are made barely sufficient to receive the iron and which becomes crushed into a solid mass against the heavier mass of the internal iron of the strake, which becomes similar to an anvil, and the shell would thus, it is believed, explode at this point and the contents be returned on those who fired it.

One of the compressors, five inches by two inches, according to Kirkaldy, would compress the strakes together with a force of 290 tons. Six of them placed as shewn in the drawing would together exert a force of 1,740 tons; and a similar double tier, at the distance of four feet on the one side, and others at a corresponding distance on the other, would in every fourteen feet exert a compression of 5,220 tons; and, they are so protected in the construction, as to be entirely out of any probable damage from shot. This power can be increased to any extent. As the whole vessel would be constructed in this way, it is not too much to say that no other vessel has ever been constructed with strength at all comparable to this method.

With respect to forts, their construction being almost similar to that for the sides of ships, it is submitted that a much closer battery can be made by this mode of construction than by any other, and it is capable of quicker ventilation.

Thus I have explained to you my plan. It is entirely novel in itself, although it cannot at the present time be said to be new, for it is something like nine or ten years since the time that the construction of a *Warrior* was the subject of general consideration that I brought my plan under notice of Sir Spencer Robinson; he introduced to me a gentleman to discuss the subject whom he called his wooden constructor.

I found, however, I could make very little way with Sir Spencer or his wooden constructor, for his estimate of the possibilities of iron was so low as to lead him to say "that he would rather go out and fight a wooden ship than any iron ship in existence." I told him that the chances were that he would never have the opportunity of fighting any other ship, and advised him for his own safety that he had better stop at home. I have essayed on several occasions since to get my plans before the Admiralty through the officers connected with it, but I always received the usual notice, that my Lords thanked me for my [illegible], but would not advise her Majesty to adopt my plan.

Mr. Bell here entered upon a history of his treatment by the Admiralty, which was of the same unsatisfactory kind as inventors usually experience. He concluded with some observations on the inefficiency of the present armouring plan for ships, and the superiority of his own invention.

After this paper had been read, the chairman (Captain Selwyn) [illegible] [illegible] Mr. J. M. Hyde [illegible] [illegible] Mr. Bell if he had [illegible] to ascertain whether a [illegible] would offer better opposition to shot than

a solid mass. It appeared to him that the cost of a target constructed on Mr. Bell's system would be very great, as it would be necessary to make special tools of an expensive kind in order to construct it. He would also like to inquire whether Mr. Bell considered any preference was to be given to any particular shape of cells. He could well understand that a properly constructed cellular body would be better than a solid mass for resisting the effect of shot, but as he was one of those who thought that artillery would always beat armour, and that guns could be made to carry shot that will go through anything, he doubted the value of heavy armour. He might observe that the Government is about to build a ship with armour two feet thick. His own view was, that protection from the effects of shot would be more readily attained by protecting the ship's sides by iron inclined so as to cause ricochet action. Such a system as Mr. Bell's was, to his mind, very difficult to reduce to practice, for he did not see how he could remove any portion of the ship's sides for repairs unless by removing all strakes from top to bottom, for, otherwise, the removal of the keys and tie-bolts would be a very difficult affair.

Mr. Hamilton Pendred also thought there would be great difficulty in getting at the tie-bolts to repair any damaged portion of the side, for the action of shot would be to weld the plates up together.

It having been suggested that Captain Selwyn (the Chairman) could give much information on the subject under discussion,

The Chairman then said he would, in the first place remark, in relation to Mr Bell's concluding statements, that the Admiralty cannot be expected to spend money unless the nation votes it, and as the vote for experiments had been cut down from £12,000 to £2,000, under such circumstances it could not be said that the Admiralty was much to be blamed. We should never get a satisfactory system on these matters until a scientific commission be appointed, composed of competent persons selected without regard to political considerations One great difficulty with reference to shipbuilding was that, as a rule, we proceed by blindly copying old forms, and it was therefore cheering to find anyone like Mr. Bell proceeding by reinvestigating scientifically the basis of the art. Mr. Bell's system raised the question of the value of absolute rigidity of structure, which had been gone into very thoroughly by railway engineers, and it had been settled that perfect rigidity was not desirable. On the whole, he was inclined to consider that a cellular system of iron war ship construction, such as Mr. Bell's, was worthy of trial. With regard to the effects of shot, many persons thought its racking effects on the plates was the great danger to be met, but the Americans have given up the racking theory, and go in for piercing. As bearing upon the behaviour of cellular or hollow constructions, he might observe that a tubular bolt was better than a solid one, for plates had not been forced off when fastened with tubular bolts, as in the case of those fastened with solid ones. The question of [illegible] was very important, for if upon being struck the ship became disabled, and could not be got to sea again from not being capable of being repaired on the spot, very [illegible] would often ensue. He quite agreed with Mr. Hyde that no [illegible] limit for the size of guns existed, and consequently the power of artillery might be said to be unlimited. In dealing with naval [illegible] to artillery, he would call attention to the fact that it is quite possible to have the guns carried below the water-line to raise them for discharge, and then lower them below the [illegible] to be [illegible] With regard to the

suggestion that a proper inclination of surface of the ship's side would be protective against shot, he must remind them that by the motion of the waves the angles would be so altered that the shot would often meet the side at an angle not suitable for turning it. To return to Mr. Bell's plan, he must say that the system of keys and ties, instead of bolts, was good—assuming the difficulty as to repairs to be met—which mechanical ingenuity would probably overcome. Finally, he would observe that if invention is to have fair play in regard to the public service, its advancement must be made a hustings question, so that wise expenditure in experiments be fully provided for out of the nation's purse.

Mr. Bell, in reply, remarked that he had tried experiments that satisfied him that the cellular construction was the best, and he felt confident that he could neutralise the power of artillery. As to the difficulty of removing the keys, it was not so great as many persons imagined, for openings would be made inside so as to get at them. He concurred in most of the observations of the Chairman, whose opinion was worthy of the highest regard, but he considered they all went to support his views. Indeed, he considered Captain Selwyn had answered nearly all the objections urged by other speakers.

The Chairman then proposed a vote of thanks to Mr. Bell, which, being seconded by Mr. F. H. Varley, was carried unanimously. After which a vote of thanks to the Chairman was proposed by Mr. Carttar, seconded by Mr Murray, and carried unanimously, and, having been duly acknowledged by the Chairman, the meeting dissolved.

RAISING SUNKEN SHIPS.

By Mr T. Vafea.

The following is, in tenour and effect, the paper read by Mr Vafea at the meeting of the Inventors' Institute, 6th March, 1874 At the opening of the paper he said that the subject he had to lay before the meeting was one of great interest and importance, and then proceeded to describe the improvements he wished to submit to the consideration of the meeting, therein referring to the specification of the patent (granted to C and T. Vafea), which stated:—We close hermetically the hatches, the deck lights, port holes, and all the windows or openings in the deck or upper or side parts of the ship, and after having so hermetically closed the said openings in the ship, we pump down air to the bottom of the ship through a tube or tubes which we insert either through the bottom of the ship's hull or through the ship's deck, and which tubes we pass down close to the bottom of the ship. The air so being introduced into the bottom of the ship rises by itself inside of the ship towards the underside of the deck, and not being able to escape presses the water contained in the ship down and out of the ship through the hole made by accident, or through holes which are to be made in the ship's bottom, to allow of the escape of the said water

The apparatus which we use for the hermetically closing of the hatches, or other openings in the ship, consists of a sheet or sheets of indiarubber or other soft packing substance, and a plate or plates of iron or other suitable material, which plates are held down and fastened to the hatches or other openings by suitable screw bolts This apparatus may also be used for keeping buoyant ships or vessels which may have met with accidents to their bottoms.

For raising sunken ships, steamers, or vessels which have been so broken as not to admit of being closed sufficiently tightly for the insertion of the air in the manner we have above described, and also for raising other submerged property, we use pontoons or other ships or vessels which are to be sunk, and attached to the broken ships or other submerged property, which pontoons or ships are then to be raised in the same manner and according to the same principle as we have described in respect to the sunken ships bringing with them to the surface the broken ships or other submerged property.

Take as an instance a ship. The ship or vessel is fitted with apparatus for the purpose of raising it, such apparatus having been placed and secured by divers, and the hatchways being covered with iron plates. Between the plate and the upper edge of the combing of the hatchway a sheet of vulcanised indiarubber or other soft packing material is laid. Such plate is secured by a cross bar which enters the hatchway and takes a secure bearing at each end beneath the ship's deck, and to the cross bar bolts are secured, which extend upwards through the indiarubber sheet and through the plate, and they receive nuts on the upper side of this plate which, when screwed down, compress the indiarubber sheet or elastic packing material, and make an air-tight joint against the top of the hatchway combing. If the hatchway be wide, the plate is further secured by two dogs, which are able to slide upon a bar to adjust them to the width of the hatch. The ends of the dogs being provided with suitable teeth, are made to clip the hatchway combing tightly between them, and the teeth penetrate it on either side. The bar, to adjust the width to the hatch, being thus fixed over the plate, the screws, which also work in holes in the bar, are screwed down, and they aid in pressing the plate home so as to ensure an air-tight joint. These bars and screws, and parts connected with them, may be applied either longitudinally or transversely of the hatchway, and the screws which they carry may be increased or diminished in number.

The plates which cover the hatchways are provided with stop cocks, by means of which the air may be controlled, allowing the air to escape whenever it is wished to lower one end of the ship which may be rising before the other. For closing the ports and other apertures in the ship or vessel similar means are employed.

Tubes of any suitable material (one or more as may be required) are attached and inserted through the bottom of the ship's hull, and their mouths enter holes formed to receive them. Through these tubes the air is pumped down to the bottom of the ship, and is caused to enter the ship close to the bottom.

The air being so introduced is left there at the bottom of the ship to rise by itself inside of the ship towards the underside of the deck, and not being able to escape, it presses down the water and expels it through the holes made in the bottom, and the upper ends of the tubes are connected with air pumps or other air forcing apparatus on board the ship or ships from which the operations are conducted, and also at their upper ends the tubes are provided with stop-cocks, which are closed when pumping ceases, and thus the air is confined, and the tube is kept free from water to facilitate the work when pumping recommences. The tubes have also valves at their lower ends which close against the water, and so also prevent its entrance into the tubes.

The above tubes are fixed either through the deck and extend down towards the bottom and close to the bottom of the ship, or passed outside of the ship's hull to the bottom of the ship

Where the sunken ship or vessel is so damaged that the apertures in her cannot be closed in the manner above described, we employ pontoons or other ships or any other vessel which, after sinking, we firmly attach to the sunken ship or vessel. The pontoons are constructed of iron, and we prefer them of a particular form with flat ends, or in some cases we make them with pointed ends,

and provide them with steam power and steering gear to facilitate the conveyance of the pontoons to the places where they may be required for use; and they are made in air-tight compartments. They have openings made quite close to their bottom, by one or more of which openings the air is to be introduced in the manner already described in respect to a ship of which the upper works are capable of being closed air-tight. The said pontoons are provided with stop-cocks by means of which the air inside the pontoon may be controlled; we allow the air to escape whenever we wish to sink the pontoons or we close the stop cocks to control the descent of the pontoons in order to bring them to the position required. The said pontoons are sunk alongside of the ship, or steamer or vessel or other weight to be raised, and having been secured to it, we make them to float by pumping down air to their bottoms through tubes, such as those used for the ships, such tubes being attached and inserted to the bottom of the pontoons from the outside or inside part of their body

Thus the air being caused to enter into the body of the pontoons and being left there at the bottom of the pontoon, rises by itself inside towards the upper part of the pontoon, and not being able to escape it presses the water contained in the pontoon down, and expels it out of the pontoon through suitable openings. We use such pontoons sometimes as auxiliaries in the raising of ships or vessels, of which the upper works are capable of being closed air-tight. The pontoons when filled with air rise, as is the case with a sunken vessel similarly treated, and in rising they drag to the surface the ship or other weight to which they are attached. The number and size of the pontoons required will depend on the weight which is to be raised.

This our principle of introducing the air from below and allowing it to rise by itself, we apply it to any other kind of vessels which we might send down, and attach to the sunken ships or other submerged property for the purpose of raising it.

By hermetically closing the hatches and other openings of ships with air-tight covers, the risk of foundering may also be greatly reduced, as when the ships are provided on their voyage with the apparatus described, namely, the air-tight covers, the air necessary to flotation is confined within the ship, and will keep the ship always buoyant, and will not allow the entrance of any water, in case the ship might meet with accident to its bottom. One or more of the tubes may also be provided, fixed either through the deck and extended down close to the bottom of the ship, or passed outside of the ship's hull at the bottom of the ship, through which tubes the air may be sent down and introduced to its bottom, and which air rising into the ship takes the place of any water which might have penetrated into the ship, and expels it, so getting rid of any leakage which might occur. The ship may also be provided with stop-cocks upon the deck, which stop-cocks may be employed on the voyage for ventilation of the cargo, the air in the ship being so renewed by opening the air-cocks during the day and closing them at night for safety.

We prefer that hatches should be of a circular form, and this would facilitate air-tight closing.

Mr. Vafea, at the conclusion of his paper illustrated by experiments on a model boat the practicability of the plan.

The paper having been read and illustrated as above mentioned, the chairman invited discussion, when

Mr. Bell said he would like to refer Mr. Vafea to the case of a vessel now in the London Docks with a very heavy cargo of wool; masts all made for the purpose of ventilation, hollow with perforations at the bottom; also other ventilating tubes so as to carry out a thorough system of ventilation. He would ask would not such a vessel present difficulties to the carrying out of Mr. Vafea's plans?

Mr. Murray thought that if the plan were found to be true in principle and capable of being carried out in practice, vessels should be constructed so that the plan might be worked whenever mischance so render it necessary to apply. He thought the present construction of vessels very unsafe. He could not fall in with the idea of closing up the vessel in stormy weather to render it buoyant; as what was to be done with the crew? Although, for the purpose of rendering the ship buoyant, he considered the invention quite practicable. He would like to know what amount of displacement was necessary to render the vessel buoyant?

Mr. Vafea explained that the lower decks only, if kept closed, will be quite sufficient to keep the vessel floating, so leaving all the upper decks for the convenience of the crew, as, according to the experiments, two air compartments would be sufficient.

Mr. Calley said he did not see how the air could be forced into a wool ship; compressed wool was so heavy; and he would ask was the power of air sufficient to displace the water in such a case He also thought that the cargo in a ship would be a difficulty that should be taken into consideration.

The Chairman (F. H. Varley, Esq.) explained that the principle of this invention was the displacement theory, and naturally the injected air would fill all open spaces, and the ship be brought to its former condition.

Mr. Macomber remarked that all boats considered life-boats have buoyant air compartments which will float the whole vessel; and, for himself, he would say that, although there might be practical difficulties in the way of carrying out this plan, he did not see why they should be considered insuperable If Mr. Vafea was right in his theory—and as far as an opportunity was afforded for forming a judgment that evening was concerned, he appeared to be right—then no doubt his invention would meet with such practical acceptance that the construction of vessels would be brought into accord with it.

The Chairman, having made a few concluding remarks of a general character, proposed a vote of thanks to Mr. Vafea; this being seconded by Mr. Carttar, was carried unanimously.

At the same meeting an invention by Mr. Debenham was introduced to the meeting. This we reserve for future notice. Mr. Debenham also received an unanimous vote of thanks; this being briefly responded to, an unanimous vote of thanks to the Chairman closed the proceedings.

THE PATENT LAW CONFERENCE.

At the meeting of the Inventors' Institute on the 2nd April, 1873, Mr. F. H. Varley, executive chairman, presiding, the conference on the Patent Laws was continued. The proceedings commenced by the secretary (Mr. F. W. Campin) reporting what was done at the last meeting of the conference (see our last issue, page 50), after which he read various communications on the subject, to the effect that a large reduction of fees is required, and the law generally amended, so as to render patents cheap and protective.

The Chairman then made some practical remarks, pointing out the necessity of cheapening the process of obtaining patents, and increasing their effectiveness.

Mr. Newton Wilson said he was afraid his notions of what Patent Law ought to be would, in some respects, differ from those of many members of the Institute. As to the cost of patents, he certainly would like to reduce the cost, but in any case would abolish the £50 at the third year, and the £100 at the seventh year, and instead of those payments would substitute an annual tax of £5. He thought there should be examination preliminary to grant of patent, and that the results of examination should be certified. He was in favour of the Patent Museum being on a grand scale, as he considered it would benefit inventors in many ways, and he advocated the system of compulsory licenses, and could not vote in favour of indefeasible patents, for he could not help thinking that patent-right was a peculiar privilege from the Crown, and not a simple legal right like property rights in general. But leaving the theory of the matter, he would now address himself to the practical, for it seemed to him that the present Government was a hopeful one for inventors, and even Lord Derby appeared to be converted as to patent law—if one might judge from his answer to the International Patent Law deputation the other day. He was in favour of the Institute organising an influential deputation to the proper member of the Government, and probably the proper official was the Lord Chancellor; but, of course, if a deputation were decided on by the council of the Institute, they would take care of that part of the question.

Mr. Murray said he could not help rising to object to compulsory licenses; they would, in many cases, be fatal to an inventor's interests. He also differed from Mr. Newton as to the indefeasible title to a patent; he thought that might, and ought to, be provided for in any amendment of the Patent Law. There was no valid reason why an inventor should have a weaker title to his property in his patent than a landowner to his land; in fact, an inventor, being an originator, or creator, had a stronger right than a landowner, who was, in reality, only an occupier with legal permanence.

Dr. Haseltine said the question of compulsory licenses was very difficult. In the abstract he objected to compulsory licenses; but it seemed to him to be a practical question of this kind—either no Patent Law or compulsory licenses. The Continentals (said Dr. Haseltine) are in favour of compulsory licenses. Americans are generally very strong against the system. At the Vienna Congress he did not himself vote for or against. In theory, he would say, no limitation of rights, but in practice it might be, and he thought it was, desirable, if properly guarded.

Mr. Yates said all this difficult question about compulsory licenses might be put aside by requiring, as in France, the patent to be kept at work. For his part, he thought an inventor ought to have a patent as a matter of right, and that it should be a perpetuity so long as he paid one-tenth of the profits to the State.

The Chairman said that he gathered from the statements of the gentlemen who had spoken that evening, and also from the communications that had been addressed to the Council, that, notwithstanding the diversity of opinions enunciated, there was concord as to the desirability of cheaper and more protective patents. In regard to the system of compulsory licenses, it seemed to him that in the event of International Patent Law being established that system became almost a necessity; but it must be fenced round with safeguards. As to indefeasible patents, the Inventors' Institute had in its Invention Right Bill put forth a plan which had been submitted to several eminent lawyers, and they had not pronounced it to be impracticable; so it could not be considered impossible or improper. As to the practical aspect of the question, at the present moment it seemed to him that the Inventors' Institute should now address the Government on the subject.

Mr. Newton Wilson then moved, and Mr. Yates seconded, the following resolution:—"That the Council be recommended to apply to the Government at an early date, soliciting them to take action for the amendment of the Patent Laws."

This being put to the meeting was carried unanimously, and with a vote of thanks to the Chairman the meeting ended.

THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON

ESTABLISHED 1ST MAY, 1862.

Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES.—SESSION 1873-4.

Attendance of Members and their Friends is requested on—

THURSDAY, May 14th.—Annual General Meeting, at 4 o'clock p.m.

THURSDAY, May 28th.—On "Elastic Screw Shafts and Thrust Blocks." By HAMILTON W. PENDRED, Esq., C.E., at 8 p.m.

TO MEMBERS OF COUNCIL.

Council meetings to take place at half-past 3 p.m. on 14th, and 7 p.m. on 28th.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

At the meeting of the Council (ordinary and special) held on April 2nd, 1874, Mr. F. H. Varley, Chairman of the Ordinary Council, presiding, the minutes of the last Council having been read and confirmed as correctly entered, the Secretary reported that the Rules' Committee had met and discussed the present rules, and suggested amendments, but were not at present prepared to make a report.

It was resolved unanimously that in any alteration of the existing rules the establishment of an Executive Council ought not to abolish the General Council, as a consultative body, in cases in which its co-operation may be desirable.

Members recorded—Messrs. J. B. Bradshaw, N. H. Hughes, and J. B. Hawley, A.I.C.E.

At the meeting of the Council (ordinary and special) held on 16th April, 1874, Mr. F. H. Varley, Chairman of the Ordinary Council, presiding, the minutes of the last meeting of Council (ordinary and special) having been read and confirmed as correctly entered, the Secretary submitted the draft accounts as further amended by himself, when it was ordered that they be remitted to the auditors to take such measures, in conjunction with the book-keeper, as to have them complete and audited for the annual general meeting on 14th May next.

The Secretary reported that at the last members' meeting a resolution was passed recommending the Council to take action to bring the Patent Law question before the Government without delay. It was thereupon ordered that the Secretary do take steps to attain that object.

Member recorded—J. Farran, Esq.

At the members' meeting on 2nd April, 1874, F. Varley, Esq., presiding, the Patent Law conference was continued. The report of the proceedings is given in another column.

At the members' meeting on 16th April, 1874, Capt. J. H. Selwyn, R.N., Vice-President of the Institute, in the chair, Mr. E. [illegible] paper on "The Construction of Iron War Ships, &c.," was read and discussed. The report will be found in another column.

Monthly Notices.

Effect of the Electric Current on the Wire.—Dr. H. Streintz, whose observations have been submitted to the Vienna Academy of Sciences, finds that the current produces an alteration in the elasticity of the conducting metal, but only such as would be due to the heat developed in the wire. The expansion of the conducting wire, however, is greater than would be produced by heating it to the same temperature; but an exception to this law appears to be furnished in the case of hard steel. When the current is transmitted, the wire expands, not suddenly, but gradually, just as would be the case under the influence of heat alone.

Dr. Helmholtz has recently brought before the Académie des Sciences de Berlin, a paper "Sur la Polarisation Galvanique dans les Liquides dépouillés de Gaz."

A German Government is fitting out, at Kiel, a deep-sea exploration expedition. We believe it will leave Europe in the month of June, and that some portion of the South Atlantic will be sounded and dredged. We are glad to know that Prof. Neumayer, the Hydrographer to the German Navy, is using his influence in the cause of science in so serviceable a manner.

The Library of the Geological Society is in course of removal to Burlington House. It was hoped that the transfer might be completed by the 29th of April.

The Death of Dr. M. Von Jacobi, so well known as the originator of the electrotype process, is reported to have taken place at St. Petersburg on the 10th of March, although Dr. Jacobi also made many important experiments on a large scale, on the application of electricity as a motive power, and recently he has very successfully rendered the electro-disposition of iron a practical feat.

Les Mondes prints in full, from the *Archives de Genève*, a complete memoir, by Prof. Kopp, upon the aniline colours of the Vienna Exhibition, compared with those shown in Paris in 1867.

The Conversazione of the President of the Institution of Civil Engineers, Mr. T. E. Harrison, will take place in the West Galleries of the International Exhibition, on Tuesday, May 19th.

The Curatorship of the Patent Museum, South Kensington, has been conferred on Col Stuart Wortley, in the place of the late Sir F. P. Smith.

The Experiments of Prof. Robert H. Thurston on the increase of resisting power of metals under stress have been repeated by Com. Beardsle, proving that the increase of resisting power is equal to 13 1 per cent. in 17 hours. The importance of these researches make it very desirable that still further researches should be made on the effect of prolonged stress, compressional as well as tensional, and with various materials.

A Gunpowder Pile Driver, by Mr. F. C. Pringle, is described in the *Journal of the Franklin Institute*. The enormous power developed by the explosion of confined gunpowder has been thus utilised with great advantage in the United States. The journal referred to describes the apparatus employed, and gives drawings of it.

Death of Mr. Owen Jones.—The decease of this eminent artist, to whom, more than anyone, we all of us owe much relief from the depressing monotony of universal whitewash and monochrome, has been recently announced. He was one of the few remaining men of eminence connected with the building of the Great Exhibition, 1851.

Death of Professor Phillips of Oxford.—We regret to have to announce, as the result of accident, the death of this eminent geologist.

The Eighty-one Ton Gun.—The *Engineer* states that the first four of 81-ton guns, which are to form the armament of the future ironclad *Inflexible*, will be proceeded with as soon as the experimental one has been completed and proved. The total length of the new gun, including the plug screwed in at the breech end, will be 27ft., and the length of bore 24ft. In the first instance the calibre will be 14in., but ample provision is made in the thickness of the steel tube to increase that figure to 16in. if deemed desirable. The rifling has not as yet been decided on, but will be a matter for consideration as the gun approaches completion. Neither the weight of projectile nor quantity of powder to be contained in the cartridge for the 81-ton gun has been positively fixed, but the first will probably range between 1,000lb. and 1,200lb., while the second may be estimated at about one-sixth of that amount.

Correspondence.

CARMICHAEL'S LIFE-BOATS.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—I mentioned in my paper that I thought a modification of my patent might be useful as a life boat. I have thought of various modifications, and prefer the one of which I send you an account.—I am, dear sir, yours truly,

DR. S. CARMICHAEL, M.D.

DESCRIPTION OF CARMICHAEL'S PROPOSED LIFE-BOAT.

1. A straight horizontal deck, about 26 feet long, and 8 or 10 broad, the middle part being a rectangle about 20 feet by 8 or 10, the two ends being rounded. This deck, which is not meant to be all watertight, may be about 2 feet, more or less, above the water line.

2. The deck is supported at this height by two horizontal tubes, containing air, one along each side, about 2 feet, more or less, below the deck; these tubes are united to the deck by four or more strong iron bars, or vertical cylinders containing air, securely fixed to the deck, and by wire braces to the sides, &c. The horizontal tubes may require to be longer than in the plan.

3. An iron keel, 2 feet or more below the middle of the deck, fixed to the central line by two or more strong bars, and to the sides by thick wire braces. If a screw and tube were adopted, this would serve the purpose of the iron keel in helping to right the boat when upset, &c. These parts should be securely fixed together by iron rods and strong wire braces in all directions, so as to form one inseparable body. The braces are not represented.

4. The deck is surrounded by a railing, with numerous openings, through which bodies may be dragged out of the water.

5. Air-tight seats. These may be carried across the deck to make it more buoyant if necessary.

6. Gaps in the deck, through which bodies may be dragged out of the water, generally covered by a grating.

7. There may be a round cabin in the middle of the deck, or a space in the middle surrounded by air-tight seats, or partly by cylinders containing air.

Rope steps or ladders may be fixed all round the deck. Both ends are meant to be alike, and there should be a rudder near each end. I have not mentioned the diameter of the horizontal tubes, as that will depend on the sp. gr. of the whole mass; but I propose that they should be nearly covered by the water when the boat is very heavily loaded.

By such an arrangement I expect that when a wave comes it will pass mostly under the deck—that the central cabin or space may be kept pretty dry—that the heavy central keel or tube, placed lower if necessary, will enable the vessel to right itself if upset—that it will suffer less from the shock of the waves, and be less liable to be upset, since there is no continuous compact side placed in the best possible position for a wave to upset it, viz., obliquely upwards and outwards, as in life boats generally, but little more than a few thin rods and thick wires, against which the waves will have little influence.

BIBLE AND GEOLOGY.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—The Bible and geology are supposed to be at variance as to the duration of this our world, but is it impossible to receive the suggestion which has been advanced both by science and theology, from their own stand-points, that this our world is not a primary, but renewed creation; and, if so, may it not be that it is our planet which has been millions of years in existence, not our present world? "We are familiar with the fact in chemistry that, on the proper combination of certain elements, new substances flash into being in a moment—when the conditions for a change, and such conditions may be external to themselves, are complete, the change may take place, not by slow gradations, but by sudden start." Might not, then, Almighty Chemistry, by the combination of past chaotic elements, when the conditions for a change were complete (through long process of gradual preparation), re-create a destroyed world by sudden start—sudden as man reckons time, *even* admitting that the Hebrew "day" be a thousand years? May not geologists be finding traces of a past world in the process of renewal?

H.

PHRENOLOGY

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—Your correspondent's letters in defence of phrenology in your issues of March and April, must have been read with pleasure by all who have found, by practical experience, the virtue of this useful—though much abused—science.

It is unfortunate that a science of such great value should have fallen into the hands of empirics, whose method of manipulation has brought reproach on its teachings. Still more unfortunate is it that those who have written much to condemn it should have so lightly passed over the works of Dr. Gall, the founder of the science. Many who have not read Gall's "Sur les Fonctions du Cerveau" concluded that he is answerable for the idle belief in certain "bumps" developed on the head, where as it is not so. Dr Gall says:—"Jamais je n'ai prétendu distinguer des modifications peu prononcées des formes du crane, ou des légères nuances du caractère."

That phrenology is a service of great value must eventually be acknowledged by anatomists; there are too many truths extant in support of its teachings to admit of its being quashed, while the numerous discussions on the subject will but strengthen the cause, and win round its portals a crowd of scientific men. If phrenology were more studied, mental pheromena would no longer remain a mystery. To test its truth upon living subjects as proposed by Professor Ferrier, appears to me a physical impossibility; were a dog to be placed under the surgeon's knife and deprived of part of its brain how could it at such a time be discovered whether the creature had lost its love for its master, or knowledge of locality?—I am, sir, your obedient servant,

HENRY GEORGE HILLIER.

Proceedings of Societies.

ROYAL SOCIETY.

MARCH 26TH.—The President in the chair.—The following papers were read:—"On the Organisation of the Fossil Plants of the Coal Measures, Part VI., Ferns," by Prof. W. C. Williamson,—"On the Motions of some of the Nebulæ towards or from the Earth," by Mr. W Huggins,—and "On the Annual Variation of the Magnetic Declinations," by Mr. J A. Broun.

ROYAL SOCIETY OF LITERATURE.

FEB 25TH.—Sir P. de Colquhoun, V.P., in the chair.—A paper was read, contributed by M. Ferdinand de Bompois, "On an Unique Coin of the Town of Lehnac, in Macedonia," in which he gave an interesting and learned account of this remarkable piece of the early part of the fifth century B.C., and suggested a new arrangement of the coins of that part of Northern Greece.

March 25th.—J. W. Bone, Esq., in the chair.—Dr. G. W. Leitner gave an account of the tribes inhabiting Dardistan, between Kashmir and Badakhshan, with specimens of the fables, songs, proverbs, &c., still current among a race but little known to European travellers. He also called attention to a collection of antiquities and objects of industry made by him chiefly in the north of the Panjab, and which he considered to exhibit many traces of the influences of Greek Art on the treatment of the human physiognomy.

ROYAL INSTITUTION.

APRIL 6TH.—Warren De La Rue, Esq., V.P., in the chair.—Miss Brandreth, Messrs. F. A. Bosanquet, E. Brandreth, R. B. Lawes, R. Nicol, W. W. Portal, E. L. Walker, and J. W. A. Woodroffe, were elected members.

INSTITUTION OF CIVIL ENGINEERS.

MARCH 31ST.—T. E. Harrison, Esq., President, in the chair.—The President stated that Capt. Tyler had asked to be allowed to withdraw his paper "On the Working of Railways," and that that request had been complied with.—The paper read was "On the Fixed Signals of Railways," by Mr. R. C. Rapier.

ANTHROPOLOGICAL INSTITUTE.

FEB. 24TH.—Sir D. Gibbs in the chair. Mr. B. Lloyd read a paper "On the Beothucs, a tribe of Red Indians, supposed to be extinct, which formerly inhabited Newfoundland" The author, after reviewing the various accounts related of the Aborigines of the island from the time of Sebastian Cabot downwards, gave the results of the information he picked up from various sources during an exploratory cruise he made last summer round the coast of Newfoundland, respecting the tribe of Indians which inhabited the island up to a period which terminated about forty years ago, when, by reason of the cruelties practised on them by the English fishermen, and the warfare carried on against them by the Micmac Indians, they were reduced in number, and finally the few of them that were left, it is thought, crossed over the Straits of Belleisle, or at all events disappeared. Mr. Lloyd also read "Notes on Indian Remains found on the coast of Labrador." The Indian remains found on the coast of Labrador consisted of rudely constructed buildings of stone slabs, which were discovered on the sea shore at the western entrance of the Straits of Belleisle. They were described to the author as Indian graves, but there was no evidence to show that such was the use to which they had been applied. On the contrary, it seemed probable they were stone wigwams, built by some Indian families for a summer residence. The author was fortunate enough to discover, at L'Anse du Diable, which is a cave situated about twenty miles east of the locality where the so-called Indian graves were found, a few arrow heads of quartzite and hyaline quartz, on a sandy "barren," which stretched inland from the head of the cave. From circumstances connected with the cave, the author concluded that the locality had been chosen by some unknown tribe of Indians for the manufacture of their arrow-heads during an occupancy of some considerable time on the spot. A paper was read, by Dr. S. Holden, "On a peculiar Neolithic Implement from Antrim."

March 24th.—Prof. G. Busk, President, in the chair.—The President exhibited and described an Ashantee skull. The specimen, with other bones of the body, was taken by Surgeon-Major Gore from an outlying camp which had been deserted on the approach of the British troops. It presented the characteristics rather of a female than a male skull, but Surgeon-Major Gore affirmed that he had never heard of the Ashantees carrying about the bones of a woman. If the skull exhibited belonged to a man, he could not have been a military leader, but he [illegible] have had such a rank in his tribe as [illegible]

him to the honours that were evidently bestowed on his remains. The paper gave full description and detailed measurements. A paper was read by the Rev. Dunbar I. Heath, "On the Origin and Development of the Mental Function in Man."—Mr. W. L. Distant read a paper "On the Mental Differences between the Sexes." The question discussed in the paper was, is there clearly proved to be a mental difference between the sexes, and is that difference one of kind or only of degree? Authorities were quoted to show the undoubted physical differences, such as weight of brain, form of skull, &c.; also the now moderately well-established fact that in primitive races the hair of women approximates more closely to that of man than obtains in a higher state of civilization. But, it having been clearly proved that the advance of man is shown by a higher form of skull and increase of the cranial capacity, an attempt was made to show some of the conditions that had retarded women in the mental struggle. The result seemed to prove that the mental divergences might be greatly accounted for, 1, by sexual selection, difference of education, and force of custom; 2, by physiological conditions,—and that, as the race progresses, the cranial capacity of the sexes, though not becoming identical, which is a physiological impossibility, will yet become much less distinct and divergent, which is a moral certainty if based on moral conclusions.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

TUESDAY, APRIL 7TH, 1874.—Dr. Birch, F.S.A., President, in the chair.—The following candidates were duly elected members of the society:—Percy Read, J. Winter Jones, Jonathan Peckover, and Henry Danby Seymour. The following papers were then read:—1. "On Four Songs contained in an Egyptian Papyrus in the British Museum." Translated with notes by C. W. Goodwin, M.A.—Of these four songs three partook of the same nature, and were amatory compositions, written in a highly imaginative and poetical style, with much voluptuousness of expression, having a very striking resemblance extending throughout whole passages to the language of the Canticles. Structurally the verses possess both rhythm and alliterative construction, with regular pauses or strophes. The first song is unfortunately in a very fragmentary condition, and is besides imperfect at the beginning and the end. In the second song these marked parallelisms occur, "The beginning of the song of joy and beauty of thy sister beloved of thy heart." "Come to the meadows my brother beloved of my heart;" "Sister, one of the lilies;" and further on, "The voice of the swallow resounds, it saith the earth is enlightened;" "Let thy hand be in my hand when I go to walk, let me be with thee in every pleasant place;" "Thou lovest me running to seek me." Nearly similar passages occur in the third song, which is also a fragment. The fourth song or hymn is of a very different nature, and is evidently one of the solemn dirges used at festivals during the exhibition of the figures of Osiris, as related by Herodotus. This hymn is in the text ascribed to King Antef, a monarch of the XIth dynasty. The ancient relic is fortunately almost perfect, and the composition is of a high order, as the following extract will testify:—"Put oils upon thy head, clothe thyself with fine linen adorned with precious metals, with the gifts of God. Multiply thy good things, yield to thy desire, fulfil thy desire with thy good things, whilst thou art upon earth, according to the dictation of thy heart. The day will come to thee when one hears not the voice, when the one who is at rest hears not the voices of the mourners" . . . "yea, behold none who go thither returns back again." 2. "Nimrod et les Ecritures Cuneiformes." Par Joseph Grivel (read in English).—In this essay the author maintained that Merodach, under his Accadian name of "Amarud, the eldest son of the Lord of Urhi" was identical with Nimrod, the "géant chasseur" of the Septuagint.

GEOLOGICAL SOCIETY.

MARCH 25TH.—J. Evans, President, Esq., in the chair.—Messrs. W. J. Lancaster, T. Parry, and H. Wilson, were elected Fellows; and Professors W. P. Schimper and I. Cocchi, Foreign Correspondents of the Society. The following communications were read:—"On the Upper Coal-Formation of Eastern Nova Scotia and Prince Edward Island, in its relation to the Permian," by Principal Dawson; "Note on the Carboniferous Conglomerates of the Eastern Part of the Basin of the Eden," by Mr. J. G. Goodchild; "An Account of a Well-Section in the Chalk at the North End of Driffield, East Yorkshire," by Mr. R. Mortimer; and "On Slickensides or Rock-Striations, particularly those of the Chalk," by Dr. O. Ward.

LINNEAN SOCIETY.

APRIL 2ND.—J. G. Jeffreys, Esq., in the chair.—Mr. J. H. Mangles was elected a Fellow. The following paper was read:—"On the Morphology of the Skull in Woodpeckers (Picidæ) and Wrynecks (Yungidæ)," by Mr. W. K. Parker.

CHEMICAL SOCIETY.

APRIL 2ND.—Professor Odling in the chair.—Papers "On Sulphocyanide of Ammonium and Sulphocyanogen," by Dr. T. L. Phipson, and a "Note on a Reaction of Gallic Acid," by Mr. H. R. Procter, were read by the Secretary. Mr. Procter finds that a mixture of gallic acid and potassium arsenate when exposed to the air acquires a beautiful green colour. Mr W. N. Hartley then read a memoir "On Cobalt Bromides and Iodides," in which he described the method of preparation and properties of these compounds. They closely resemble the corresponding chlorides. Fine specimens of the different salts were exhibited by the author. Mr. E. Neison read a paper "On the Distillation of Sodium Ricinoleate," and Mr C. H. Piesse a "Note on the Solubility of Plumbic Chloride in Glycerine." Mr. Kingzett had a communication "On Ozone as a Concomitant of the Oxidation of the Essential Oils, Part I.," and from his experiments he infers that the compound produced during the oxidation of oil of turpentine is neither ozone nor hydrogen peroxide, but a hydrated oxide of turpentine. The last paper was "On the Action of Chloride of Benzyl on Camphor, Part II.," by Dr. D. Tommasi.

ASTRONOMICAL SOCIETY.

APRIL 10TH.—Prof. Adams, President, in the chair. Mr. De La Rue gave a verbal description of a piece of apparatus which he had devised for carrying out M. Janssen's method of photographing Venus near to ingress and egress upon the Sun's disc. The instrument is intended to be attached to the photo heliographs, and weighs less than eleven pounds, inclusive of a small driving-clock, which carries a revolving plate of about ten inches in diameter, on which small photographs of Venus and the Sun's limb are to be taken. Lord Lindsay described the form of instrument which he had devised for the same purpose: it appeared to be very similar to that described by Mr. De La Rue, except that it is mounted on a separate pillar from the telescope, in order to avoid tremors. Lord Lindsay also read a paper "On a Method of Determining the Solar Parallax from Observations to be made at the next Opposition of Juno, which occurs in November of this Year." He proposes, while in the Mauritius, to make a series of heliometric measures of the distance of Juno from the nearest fixed stars; and, by comparisons of the measures taken soon after Juno has risen above the eastern horizon with those taken before it sets at the western, to determine the terrestrial parallax. By this method he will be able to make his measures during all the clear nights of the month, or six weeks before and after Opposition; and although the Parallax will be considerably less than in the case of Venus, he considered that he had reason to hope that the probable error of the result would, owing to the number of the measurements, and the ease of dealing with points of light instead of discs, be less than either in the case of the Transit of Venus or the Opposition of Mars.

MATHEMATICAL SOCIETY.

APRIL 9TH.—Prof. Cayley, V.P., in the chair.—Mr. J. Hammond was proposed for election; the Rev. Prof Townsend was admitted into the Society; and Prof. C. Niven and Mr. T. Muir were elected Members.—The following communications were made: "On the Probable Error in Statistics," and "The Combination of Statistics," by Mr. G. H. Darwin,—"The Determination of the Form of the Dome of Uniform Stress," by Mr. C. W. Merrifield. Mr. A. J. Ellis gave an explanation of this theory that ordinary (commutative) algebra is the calculus of similar triangles upon one plane. Prof. H. J. Smith spoke upon the higher singularities of plane curves. A paper by Mr. H. M. Taylor, "On Inversion, with Special Reference to the Inversion of an Anchor-Ring," was taken as read.

MICROSCOPICAL SOCIETY.

APRIL 1ST.—F. H. Wenham, Esq., V.P., in the chair. A list of donations was read, and Mr. R. Horne was elected a Fellow. A paper "On the Structure of the Lepisma Scale," by Dr. Anthony, was read, in which the author showed that the two sets of markings were upon opposite sides of the scale, the ribs being upon the under side. The paper was illustrated by drawings, and led to a discussion, in which Mr. M'Intire, Mr. Slack, and the Chairman took part. Mr. Wenham gave a demonstration of his method of measuring the angular apertures of objectives, and explained his mode of stopping out the extraneous rays which were so frequently a cause of error. The subject created some interest, and the means and importance of stopping out false light were discussed by Messrs. Ingpen, Slack, Stephenson, and Wenham. Mr. S. J. M'Intire read a short paper describing the proboscis of a moth (believed to be a South African species) which was furnished with a means of perforating the nectaries of flowers. A mounted specimen was exhibited under a microscope in the room, and drawings in illustration of the paper were placed upon the table. Further remarks upon the subject were made by Mr. C. Stewart and Mr Wenham.

GEOGRAPHICAL SOCIETY.

APRIL 13TH.—Right Hon. Sir H. Bartle Frere, K.C.B., in the chair. The papers read were—"Majwara's Account of the Last Journey and Death of Dr. Livingstone," by Mr. F. Holmwood,—and "Journey through Kuldja and Russian Turkestan, with Remarks on the Hydrography of that Region," by Mr. Ashton W. Dilke.

The French Minister of Agriculture and Commerce announced at a late meeting of the Assemblée that it was proposed to give M. Pasteur a pension of 12,000 francs, for the eminent services he has rendered to science.

The "Composition and Culture of Tobacco" is the title of the report made by Mr. S. W. Johnson to the Connecticut Board of Agriculture. The chemical examination of New England and Kentucky tobacco is of considerable interest, and the statement of the rate of exhaustion of the soil by its growth, which is now shown not to be very great, is valuable.

MANCHESTER EXHIBITION OF APPLIANCES FOR THE ECONOMICAL CONSUMPTION OF FUEL.

Our second visit to this exhibition confirmed the opinion expressed in the preliminary notice last month, namely, that a decided step has been taken towards the solution of the great coal question; and, although many advanced minds may feel disappointed that something far more extensive was not attempted, yet the public of the cotton metropolis have reason to congratulate themselves that so much has really been accomplished.

It is by no means our intention to notice in this report everything which is exhibited, as neither space nor time for such an exhaustive method of procedure are at our disposal. We purpose to record those things which—during several careful perambulations round the building, coupled with frequent opportunities of hearing explanations of the various exhibits from the attendants—we have come to consider of the greatest importance, and most worthy of notice. At the same time, we would wish to observe that our silence upon a great mass of exhibits must not be construed into either condemnation or praise, but that a variety of causes have combined to keep them in the background.

Upon first entering the building, a great show of "economisers" arrested the attention; the principal of which are Green's, Twibil's, Neild's, and Bell's. The two former have been long before the public, and are well known. They are formed of a series of vertical pipes, through which the water circulates, and are fitted with reciprocating scrapers, worked by suitable mechanism, for preventing any accumulation of carbon from the heated gasses, which pass by them on their way to the chimney. The arrangement of tubes is very similar in both cases, the principal difference seeming to be in the form of the scraper and mechanism. In the method shown by Neild, the tubes are constructed in the form of rings, one above another, with upright connecting pipes; the scrapers in this case being a continuous circular motion. In Bell's apparatus, the tubes take a spiral form, the scrapers travelling round and round the same until the top of the spiral is reached, when, by reversing gear, they are caused to descend.

Both these methods have the advantage of a great reduction in first cost of apparatus, and would appear to do the work required very effectively. The one has the advantage of a simple and continuous motion in its mechanism, but the other has excellent facilities for circulation, which probably more than compensates for the slightly increased complication

In passing along we arrived at Hurd and Simpson's coal getter, which has the appearance of a substantial and really practical machine. Mather and Platt, of Salford, came next, really a splendid show; the most attractive part of which being their underground hauling engine. The workmanship shown by this firm being, as might be expected, very fine indeed, and reflecting credit upon the locality. Mechanical stokers exhibited by Mr. Dillwyn Smith and Mr. W. Young, both we found to be creditable attempts in this direction. The annexé for household grates here came into view, and it is in this portion of the exhibition where we saw much interest displayed by the fair sex. Amongst noteworthy exhibits in this department, a range by Newton and Chambers, of Sheffield, must be named; several ranges shown by Shillito and Shoreland, Elliott, Alston and Co., and Fallows and Bates, a curious arrangement called the "vacuum draft," invented by a clergyman; also a good specimen of grate by Leech Brothers. Perhaps Wadsworth's "Metropolitan fire" must be ranked as the most original exhibit in this department, which, if improved in appearance or design would be exceedingly well adapted to the needs of the metropolis. Strange as it may appear, the fire space in this arrangement is only 8 inches by 5 inches by 5 inches, from which the amount of heat contrived to be radiated is really surprising. A very good kitchen range is found next to this, viz., the "Universal," by Sanderson and Proctor, of Huddersfield. Gas stoves so familiar to us all at this day were also shown in great variety; but the only thing that seemed practicable and noticeable was Wallace's arrangement of gas-heating apparatus. Upon leaving this locality, we seemed to enter a perfect wilderness of odds and ends, such as fire bars of all imaginable shapes and forms, both moveable and stationary, peat machinery; coating for steam pipes, and a number of other things, some few of which it requires a little thought to connect with economy of fuel. But, as we progressed, steam boilers or generators themselves came into view, in which the greatest economy of the future must be looked for. Under this head we must first notice a splendid boiler, in point of workmanship and finish, by Galloway and Son, constructed on their well-known system. Also a very good boiler of the usual type by Clayton and Son, of Preston, driving the machinery in the exhibition. But from the attention paid by frequenters of this and other exhibitions, and the interest displayed by engineers generally in sectional boilers, it would appear that it is from amongst this class that the boiler of the future will be found Of these, Root's, Griffith's, and Shepherd's seem to claim the most attention. Now, with regard to the latter, the Manchester Sectional Boiler Company, who are the proprietary, we found a working boiler on exhibition at another part of the town under steam. We may say that when we attended this supplemental exhibition, we saw the boiler under a pressure of 107 lbs. to the square inch, and certainly doing some very extraordinary evaporative duty, and far in excess of what we had previously seen accomplished with any form of steam boiler whatsoever. The same company show a very simple and ingenious apparatus for extracting water from steam (also the invention of Mr. Shepherd), which seems to be very generally coming into use, and must assuredly be of great service where trouble arises from priming.

Passing on, a gas engine came in view, shown by Crossley Brothers, of Manchester, which should be useful to printers and others requiring little power. Near to this is a model of Robey and Co.'s patent oven for pottery ware, which seems to be economical in the use of its fuel Near to the door we noticed Oswald Rose's piston, Hallam's safety valve, and Gifford's injector, which speak sufficiently for themselves.

One model, apparently little noticed, seemed to us to be of immense importance; Clott's ventilation of sewers. We believe this plan is actually at work, with the most beneficial results, at a place near to Halifax, in Yorkshire, and that it clears the sewers there of all obnoxious gases, as well as utilizing the same as fuel. This is a matter that our corporate bodies throughout the country should enquire into, as it would seem that the means of purifying the drainage of the whole nation are here at hand, and of a very simple and cheap character.

We understand the Exhibition was to close on the 12th of April; but we trust the good example which has here been set will be imitated by all our large centres of industry throughout the kingdom, as if this is done even to a limited extent, we are inclined to think the great coal problem will be rapidly in a fair way for solution.

We have again to record our thanks to Mr. W. Gadd, C.E., Manchester, for enabling us to present our readers with this report on the important and practical Exhibition there.

MACHINERY WITHOUT LUBRICATION.

Our contemporary, the *Mining Journal*, calls attention to a recent invention, having for its object the dispensing entirely with the use of lubricants in all classes of machines, which is now on its trial with every prospect of success. The value of such an invention cannot be over estimated when the resulting cleanliness, saving of the cost of lubricants, and of time and attention in oiling bearings is considered. For the ordinary metal bearings are substituted others of a peculiar composition, less than half the cost of metal, but which can be turned, bored, and is otherwise susceptible of treatment similar to metal. In consequence of the inventor, Mr. S. Cohné, being an exhibitor at the International Exposition at Vienna, and from that cause then resident there, the first experimental bearing of this composition was tried at the machine works of Messrs. Dolainski, of Vienna. It was placed in position on August 24th last; and recent intelligence from that city confirms that this bearing, which has been in constant use from that date without any lubricant, is still in admirable working order, the shaft running "coolly, smoothly, and continuously." In this country a bearing placed in position at Messrs. Waterlow and Sons' Works, London Wall, on February 16, is at this time in perfect order, the shaft being bright and smooth, and no grease nor oil having been used. This is on the driving shaft, near to it is taken the motion for driving two large printing machines, and several other machines are driven by the same shaft. As a proof of its working satisfactorily, another bearing is now placed on the steam-engine at the same works. These bearings are now in use at the Bessemer Steel Works, Greenwich; at Messrs. Simons Brothers, engineers, Southwark, the Dartford Gunpowder Mills; Mr. Starnes' Engineering Works, Ratcliffe; at the works of Messrs. Virtue, City-road; and the London Cotton Mills, Bermondsey, besides other places, and are being tried on the axle boxes of the South Western and Midland Railways with every prospect of success. The test at the Bessemer Works has been a severe one, it being a rail cutting mill upon which the bearings are placed, the shaft running at the rate of 1,400 revolutions per minute. Those at Messrs. Symons Brothers are upon a very heavy grindstone, where they are subject not only to very great strain, but also to the flying in of the grit from the stone, yet, as in all the other cases they are working well. M. Cohné has lately visited Manchester, and is now engaged in making bearings for the numerous machines employed in the manufacture of the textile fabrics in that quarter. A recent estimate places the number of spindles in these machines in Great Britain at 36,000,000. Here, then, alone is an immense field for Mr. Cohné to labour in, and an almost incalculable saving to be effected, for let it be borne in mind that dispensing with the lubricant in these machines means not only economy in that way, but the saving of a large quantity of material now damaged by contact with the oil. The spindles in these machines run at a very high speed, but the new bearings are equal to the requirements, for at the experiments carried out by Mr. F. C. Smith, engineer, Grantley Works, Peckham, some were successfully tested up to 9,000 revolutions per minute. They are now in use in Manchester and Oldham, and are giving great satisfaction.

Should Mr. Cohné's invention realise the expectations reasonably formed from its applications thus far, the liability to accidents will be greatly lessened; for it is well known that these frequently occur in oiling bearings. Another source of consolation will be that these new bearings are not likely to find purchasers at the old metal shops, to which their more attractive looking rivals, now frequently gravitate. The thanks of those that "go down to the sea in (steam) ships"

will also be gratefully rendered to the inventor, for who has not felt nausea from those most gross and fatty smells from the engine room.

As to the comparative durability of these bearings with the metal ones, it should be stated that the first bearing at Vienna, now nearly nine months in use, does not exhibit any signs of wear or deterioration.

PATENT LAW REFORM.

SPECIAL NOTICE TO MEMBERS OF THE INVENTORS' INSTITUTE

As the upholding and improvement of our Patent Laws form one principal work of the Inventors' Institute, it is desirable to call your attention to its two next meetings, viz., on 19th March and 2nd April, as these are to be conferences of the council and members on the Patent Laws. The advent of a new Government and a new Parliament makes the present time one that may, under all circumstances of the case, be fairly considered a crisis for the Patent Law question; hence it seems very desirable that these conferences should afford full and decided expression of the views of the whole body of members on the important subject referred to, so that the Council may find itself better prepared for immediate action of a satisfactory character. This will be best effected by your attending the meetings above-mentioned (or one of them), and stating your views thereat; but, if that should be inconvenient, it will be quite open to you to communicate your views in writing to the Council; and in doing so it would be well if you would refer to the following summary of the propositions the Inventors' Institute have already put forward (see the proposed Inventors' Right Bill published in the Institute's journal—the SCIENTIFIC REVIEW—for July, 1871, and abstract thereof published in the same journal—SCIENTIFIC AND LITERARY REVIEW—for September, 1872, and the articles No. 1 and 2 on "Revision of Parliamentary Report on Patents," in January and February in the present year).

The points above referred to are:—

1. A large reduction in the cost of Letters Patent (one-half has been suggested).
2. Amendment of the procedure for obtaining Patents.
3. General reform of the Patent Office and Patent Museum arrangements.
4. Amendment of the legal procedure for repression of Infringements, and of unwarrantable assumption of Patent Rights, so as to render the same more certain and far less costly.

Each member will greatly facilitate the object in view if only he will kindly communicate his views as to what importance he attaches to these points, and what he considers to be the relative value of each point, *i.e.*, whether the first or any other is more pressing for amendment than the others, &c.

The meetings for members commence at 8 o'clock p.m.

F. W. CAMPIN, Secretary.

Inventors' Institute 4, St. Martin's Place, Trafalgar-square, 14th March, 1874.

P.S.—The remaining meetings for this session are on Thursdays, March 19th, April 2nd, 16th, 30th, May (Annual General at 4 o'clock, afternoon) 14th, May 28th, June 11th.

For the subjects other than above to be considered at these meetings, see the Monthly Notices in the SCIENTIFIC AND LITERARY REVIEW.

Attendance of members and friends is requested.

* * As the Secretary of the Inventors' Institute fears that every Member has not received the above notice, we insert it at his request.—[ED. S. & L. R.]

PATENT LOGOTYPES.

Patent logotypes consist of (1), words, syllables, or two or more letters cast in one piece; (2), figures cast in various combinations; and (3), words, syllables, and letters having the characters sunk into the foot of the type.

It has been demonstrated that by a judicious use of syllables and words, cast in one piece instead of in single letters, a saving of more than one hundred per cent. is effected, monotonous toil abridged, and correctness in the work of the compositor brought to a much higher point than under the ordinary system.

Suppose a compositor has to put together the following sentence: "The question before us is therefore reduced to very narrow limits." The mode as practised at present would involve 55 lifts for the letters and nine for the spaces which divide each word, making a whole of 64 lifts. With the patent logotypes there would be but 23 lifts—"The que-s-tion be-fo-re us is the-re-fo-re re-du-ced to ve-ry na-rr ow li-mi ts."

With logotypes a compositor can, after three months' practice, set up 4,000 letters in an hour; under the ordinary system men who have worked at it for twenty years very rarely attain to 2,000 per hour.

Boys of ordinary intelligence can with six weeks' training put together between two and three thousand letters per hour. The objection that such a large number of combinations must require exceptional powers of memory is met by the fact that, in the experiments made with lads of about 14 years of age, a week's practice has been sufficient to give the learner a tolerably accurate notion of the position of the types, while with a fortnight's training he has been capable of going unerringly and without hesitation to the proper compartment.

The advantages of legible types and logotypes are that very little special training is necessary to make a proficient compositor. Being in consonance with the laws of optics, the character is palpable to the eye, and the task of correcting, so notoriously irksome even to professional compositors, can be easily performed without a proof-sheet, and by the merest tyro.

The introduction of the new system would assist in the solution of one of our great social questions, women and girls could be trained into skilled compositors in a very short time.

In conclusion, the attention of those more immediately connected with the printing trade is drawn to the following facts: Very few compositors can at present set up 2,000 letters per hour: with logotypes an ordinary hand will have no difficulty in composing 4,000; and the probability is that constant practice will greatly add to his celerity.

This invention is exhibited by Colonel Tomline at the International Exhibition, South Kensington.

CRYSTAL PALACE SCHOOL OF PRACTICAL ENGINEERING.

THE distribution of certificates of merit to the students who have successfully passed the examinations in this school took place on the 25th ult. in the Lecture-room, in the South Tower of the Palace, in the presence of a considerable number of the parents and friends of the students. In the floor above the lecture room were a number of finished drawings, which had been executed by the students during the term, and the surveys of a complete imaginary railway and docks in the grounds of the Palace. There were also exhibited some castings of parts of engines, and in the fitting shop there was a steam engine of three-horse power which had been planned, built, and finished entirely by the students, and which it was stated, was already sold. Mr C. W. Siemens, D.C.L., F.R.S., member of the Council of the Inventors' Institute, gave away the certificates, and, in the course of a prefatory address, said, though this school had been established but a short time, it had already brought forth fruit of no mean character. He was glad to see, in going through the workshops of the establishment, that the students not only comprehended the principles on which construction should be based, but had actually mastered those practical details which led up to practical and useful performance. Mr. Shenton, the superintendent, read the report of the examiners, and the certificates were distributed—those who obtained the highest number of marks being:—For lecture question on steam, Mr W. Michels; for the best work in the drawing office, Mr. L. K. Kinder; for the best work in the pattern shop, Mr. C. Gree; and for the best work in the fitting-shop, Mr. W. Michels.

APPLICATIONS FOR LETTERS PATENT.

(Continued from page 62.)

On January 23rd.—284 to 305.—P. P. F. Michaud. Production of tannin and cane-arpine.—T. Pakenham. Singeing pigs by the application of gas.—T. Walker. Utilising the waste heat of steam engines.—A. Lacase. Weaving loom (com.)—W. Sellers. Sewing machines.—P. E. Lockwood. Method of treating beer, ale, porter, and other beverages.—A. M. Clark. Apparatus for propelling vessels (com.)—F. J. Noule. Ratchet braces.—A. M. Clark. Mechanical toy (com.)—T. Walker. Means of transmitting electric currents for telegraphic and other purposes.—J. Saxby. Railway points and signals.—F. Rath. Plaited creased, or folded fabrics.—F. J. King. Treatment and separation of ores and mineral products.—J. M. Smith. Medicinal compound, and plaster made therewith (com).—L. Finger. Electro-magnetic annunciators. (Complete specification.)—S. C. Lister. Preparing and combing waste silk and wool or hair.—G. H. Rew. Syphons.—E. H. Hache. Mechanical apparatus for indicating by clock-work the excessive pressure of lighting gas (com.)—S. L. Delalot. White metal, to be termed "metal delalot."—W. Hones and W. Burley. Carriage lamps.—J. Harris. Sewing machines.—J. Turney. Apparatus for drying or finishing glue.

On January 24th.—306 to 323.—J. Maynes. Machinery for turning and cutting wood, metal, and other materials.—A. Brown. Dredgers.—J. Imray. Regenerative furnaces (com.)—H. Cockerham. Looms for weaving striped fabrics.—W. H. Harfield. Capstans and windlasses.—W. W. De la Rue and W. T. Shaw. Calendars or date indicators.—J. Gruby. Umbrellas and parasols.—C. Brakell. Looms for weaving velvets and other pile fabrics.—C. M. White. Tobacco pouches.—W. Williams. Hanging and arrangement of window sashes and stiles, and the fittings connected therewith.—F. Condit. Weaving ribbons and other narrow fabrics, and looms and apparatus used in connection therewith (com.)—E. F. R. Lucas. Manufacture of anthracene.—I. Chippindale. Apparatus employed for sifting cinders or ashes.—Duke of Sutherland. Implements to be used in cultivating waste or moor land by steam power.—G. H. Chubb and W. H. Chalk. Safes.—F. Gebauer. Rotating hydraulic mangle.—A. M. Clark. Process for eliminating the soluble principles contained in gases and vapours (com.)—A. M. Clark. Drying and heating purposes (com.)

On January 26th.—324 to 334.—A. Muzzarelli. Bleaching animal glue of all kinds.—J. C. Ramsden. Machinery for spinning, doubling, or twisting wool.—E. Lowe. Material to be used in lieu of coal for fuel.—A. Budenberg. Injectors for raising and forcing fluids (com.)—E. Dyer. Fire escapes.—T. Wilde. Railway chairs.—T. Cannon. Apparatus for preparing materials for the manufacture of glue.—J. Howard and E. T. Bousfield. Steam boilers.—E. Noakes. Kilns for curing hops.—J. S. Adams. Kaleidoscopes (com.)—S. D. Tillman. Indicators for determining chords and musical intervals of the diatonic scale. (Complete specification.)

On January 27th.—335 to 351.—J. S. Summerford. Reclining chair.—D. Cunningham and A. Douglas. Manufacture of Scotch or other

similar bonnets, caps, or hats.—D. Wormald. Machinery or apparatus employed in the manufacture of cut nails.—C. C. Burton. Wheels for traction engines, and for other uses where a considerable area of bearing surface is required. —C. Kyte. Furnaces applicable for reducing iron ores preparatory to working the same into manufactured iron (com.)—S. Swale. Preserving life at sea.—H. C. Hill. Machinery for winding yarn and thread.—W. R. Lake. Apparatus for maintaining a constant level of water in wet gas-meters, and for separating from vapour liquid held in suspension in the same (com.)—J. Wilde. Machinery for grinding and polishing all kind of saws, files, or other flat metal surfaces.—E. Wolf. Pipe for smoking.—G. Smith. Beverage or artificial apollinaris water. —H. Glover. Manufacture of sulphuric acid.—G. G. Tandy and J. A. Dryden. Lamps.—J. Whittingham. Manufacturing gas for illumination (com.)—J. H. Johnson. Apparatus for cleaning or polishing floors and other like surfaces (com.)—A. M. Clark. Machinery for cutting and screw-threading pipes (com.) (Complete specification.)—A. M. Clark. Combustion of fuel in furnaces and other fire-places (com.)

On January 28th.—352 to 364.—J. Horrocks. Furnaces for supplying heat to steam generators and for other purposes.—P. Charles. Apparatus for controlling the supply of water to closets, lavatories, and other places, and preventing waste.—W. A. Gilbee. Cork cutting machinery, parts of such improvements being applicable to other purposes (com.)—J. Reed. Boilers and furnaces.—W. T. Mann. Cranes (com.)—E. Taylor. Washing machines.—J. H. Johnson. Self-braking lowering and hoisting apparatus (com.)—W. West and W. F. Spittle. Solitaires, sleeve-links, and other like dress fastenings.—F. Hann. Manufacture of compressed fuel.—J. Mapleaden and W. Buss. Ploughs.—F. Bucknall. Machinery or apparatus for digging potatoes and other agricultural roots, and for cultivating land. A. M. Clark. Sewing-machine cabinets (com.) (Complete specification.)—A. M. Clark. Instrument for cutting buttonholes and slits (com.)

On January 29th.—365 to 383.—G. Somerville and G. Crombie. Guillotine machines for cutting paper, cardboard, leather, cloth, and other similar materials.—D. Joy. Hydraulic motive-power engines.—F. W. Gerhard. Purification of iron ores and other compounds containing iron, and production of iron therefrom. —G. R. Kaye. Apparatus for cutting or reducing meat into small portions for various purposes.—J. F. Stephens. Shirt-fronts.—T. P. Merriam. Apparatus for soldering metals.—E. Stevens. Brake for arresting or retarding the wheels of railway and other vehicles.—T. Hopcraft. Telegraphic apparatus for transmitting messages.—A. Friedmann. Heating steam boilers of steam ships.—A. Collingridge. Axle-boxes applicable to locomotive steam engines, railway carriages, &c. (com.)—E. Heyworth and W. Smalley. Steam boilers.—J. Richards. Bicarbonate of soda.—E. Seyd. Apparatus for indicating the revolutions or motions of machinery.—G. H. Wilson. Keyless watches and appliances for winding the main-springs, also for setting the hands thereof.—H. S. Snell. Stoves or apparatus for heating purposes.—G. T. Bousfield. Electrical machines (com.) (Complete specification).—T. Norton and H. Hollawell. Weaving velvets and other piled fabrics. —J. I. Thornycroft. Light-draught screw-propelled vessels.—J. Harrison. Process of evaporation, condensation, and refrigeration, in their relations and applications, and apparatus therefor.

On January 30th.—384 to 391.—J. Edwards. Valves.—E. Newbold. Furnace bars.—F. C. Smith. Cutting woollen fabrics or materials.—R. H. Kay and A. T. Richardson. Manufacture of silk crape.—D. M. Isaacs. Fire-escape.—J. Wood. Ornamentation of papier maché and other japanned wares.—J. A. Fowlett. Steering apparatus for ships.—T. Woodcock. Carving the horns of other animals so as to imitate the horns of the stag.

On January 31st.—392 to 405.—F. E. B. Beaumont. Steering vessels by fluid pressure.—J. J. Webster and J. G. Thompson. Cleaning tramway tracks.—J. Girvan and J. J. Cathro. Ornamenting paper for hangings (partly com.)—R. MacLean. Preventing railway accidents.—J. Blake. Steam generators and safety valves. —R. Dearman. Economising fuel and consuming smoke.—E. A. Leigh. Carding and spinning cotton, wool, and other fibrous substances.—E. Hughes. Producing ornaments and designs, also goffers, plaits, and crimps in ribbons and other fabrics and cords.—H. D. Davies. Materials for roads and roadways to prevent horses slipping thereon.—G. Blaxland. Raising sunken vessels.—W. Coppin. Ships.—T. Lumley. Steam pumps.—H. Cherry. Steam pumps.—W. Goulding. Folding chairs or seats and tables, &c.

On February 2nd.—406 to 423.—G. Read. Stoppers for bottles to contain aerated liquids. —C. C. Cramp. Tramways.—W. T. Black. Switches for railways.—E. E. Middleton. Altering by lengthening by the stern the after-built of yacht, sailing boat, or other vessel.—C. Wichmann. Elastic steel railway "frog" for crossings (com.)—W. F. Stanley. Circular saw bench.—W. F. Stanley. Points for mathematical drawing instruments.—I. Davies. Machine for opening or separating plates of iron known as "black plate" after leaving the black plate mill.—C. D. Abel. Gas motor engines (com.)—J. Marchant. Safety signals for railway points or switches.—L. M. Pichard. Saw teeth for carding engines.—C. Cooper. Working points of railways.—W. E. Newton. Shears for cutting bars or rods of iron and other metal or material.—F. A. Walton. Fastenings for wearing apparel (com.)—J. H. Johnson. Machinery for carding, combing, and cleaning cotton and other fibrous substances (com.)—A. M. Clark. Embossed gilt and silver mouldings (com.)—A. Browne. Alloys of iron (com.)—W. R. Lake. Gum and gum like substances from linseed oil and other similar oils (com.)

On February 3rd.—424 to 441.—W. Beck and W. Strong. Bricks.—C. Lowe. Separation and utilization of certain mixed chemical products.—M. Benson. Pipe tongs and cutters (com.)—E. Brook and A. Wilson. Consuming fuel in furnaces for raising steam, and other furnaces. —C. W. Siemens. Treatment of puddled balls and apparatus therefor.—W. Stevens. Heels for boots or shoes.—C. Dewynter. Hydrocarbons purificatory apparatus for illuminating gas (com.)—T. R. P. Dennis. Water waste preventor.—T. Hyatt. Carriage and footways.—E. O. Brewer. The incineration of mixed vegetable substances from wools or woollen fabrics by the application and manufacture of chloride or chlorate salts, preferably of zinc, magnesium, and aluminium, applicable to unbleached and dyed or coloured materials (com.)—F. Leonardt. Boxes or receptacles for holding pens, buttons, needles, and other small articles. —W. Gibson. Castors for furniture and other articles.—J. Pickup. Looms for weaving.—J. Shuttleworth. Looms for weaving.—A. M. Clark. Hoeing, path-cutting, and raking. (com.) (Complete specification.)—H. Highton, M.A. Electric telegraphs.—S. J. Mackie. Signalling on railway trains.—A. V. Newton. Metal tubing (com.)

On February 4th.—442 to 460.—F. W. Webb. Railway points and signals.—J. B. Hamilton. Musical instruments.—G. McCallan. Reflectors. —G. B. Northcote. Apparatus for scraping and cleaning boots.—A. Heaven. Embroidering and ornamenting woven fabrics.—J. Macintosh. Materials for insulating telegraphic wires, part of which material is also applicable to covering other substances and rendering them waterproof.—J. Hargreaves. Manufacture of sulphates of soda and potasse, and apparatus or appliances employed therein.—J. Macintosh. Roads, ways, and the materials used.—W. Morgan-Browne. Lasting boots and shoes (com.) —H. J. West. Production of ice and apparatus therefor.—H. Smith. Window blind raising, lowering, and arresting apparatus, and blind rollers.—S. Makin and W. Skerratt. Throstle, worsted, spinning, and doubling frames.—H. H. Murdock. Treatment of leather, called "sole leather," for the purpose of hardening it and rendering it impervious to water (com.)—J. H. Johnson. Preservation of whites and yolks of eggs (com.)—C. Watterson. Manufacture of several oleates of potash, soda, and ammonia, commonly known under the name of soluble oil, and applicable in the process of finishing prints, calicoes and silk goods, and other cotton and silk dyed goods and velvets.—B. Andrade. Sausage meat chopping machines.—W. E. Newton. Bolsters and step bearings for the spindles of spinning frames, applicable also to other spindles and shafts (com.)—A. V. Newton. Air-heating attachment and ventilator (com.)—J. Marshall. Furnaces of portable, agricultural, and other steam engines required for burning straw and other light vegetable matters.

On February 5th.—461 to 480.—F. F. Warren. Pots for flowers and plants.—J. A. Callender. Railway signals.—K. W. Hedges. Combined steam boilers and steam engines.—J. E. Shotman. Stoves or fire-places.—J. Webster. Manufacture of steel.—L. F. Taverner. Felts and felted fabrics.—R. M. Caffall and A. Thomas. Effecting the automatic sealing of hydraulic gas mains, and for removing the pressure of gas on retorts at pleasure.—J. Hall. Machinery for squeezing or extracting the liquid matter from "spent tan," "spent hops," "old used waste," and other materials.—F. Coats, jun. Machinery for re-winding yarn or thread. —W. Page. Steam ships.—H. A. Bonneville. Table for advertising (com.)—H. A. Oldershaw. Machine for turning down and fitting the gussets and other parts of boots and shoes.—W. R. Lake. Combined life-preserving dresses and air buoys (com.)—G. Haseltine. Sewing machines (com.) (Complete specification.)—J. H. Johnson. Treating or heckling flax and other fibrous materials (com.)—T. B. Groves. Cigarettes and cigars.—J. Hooker. Type setting and distributing machines.—T. Hyatt. Treatment of asbestos and its application to various useful purposes in the arts and manufactures.—J. Backhouse. Steam cultivating implements.—A. M. Clark. Treating and separating the constituents of maize for the production of flour (com.)

Recently a deputation, consisting of Messrs. Paul and Huckrah, introduced by the Right Hon. J. W. Henley, M.P., had an interview with the Right Hon. Sir Charles Adderley, at the office of the Board of Trade, to exhibit a model of a new railway switch and locking apparatus.

THE INVENTORS' INSTITUTE,

ESTABLISHED 1st MAY, 1862.

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CONTENTS.

APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur-street, Charing Cross.

On February 6th.—481 to 490.—H. Elder. Railway brakes.—J. O. Baxtor. Boilers and engines or apparatus for obtaining motive power by means of elastic fluids.—W. G. Thwaites. Apparatus for securing watches and valuables.—P. Frankenstein. Waterproof overcoats.—J. J. Harrop. Tin-lined lead piping, and tin and lead piping, soil and water pipes, and apparatus employed, and covering of telegraph cables with lead.—S. Ford. Prime movers actuated by the explosive force of mixtures of gases.—J. Ledbrook and J. H. Mills. Self-adjusting all kinds of railway signal and other wires.—C. W. Kayser. Steam, hydraulic, blowing, pumping, or water engines (com.)—J. W. Moore and J. Norman. Harness saddles or "pads."—J. Barnett. Apparatus for obtaining and applying motive power.

On February 7th.—491 to 503.—C. O. Cramp. Construction of tramways and apparatuses connected therewith.—W. S. Von Essen. Apparatus for cleaning tubes of steam boilers.—J. Hock. Motor engines worked by the combustion of petroleum or other liquid hydrocarbons.—F. W. Webb. Mechanism or arrangements for actuating railway points and signals.—M. Benson. Welding copper (com.)—R. Quin. Cases for cigars and similarly or approximately formed articles.—L. Rose. Stopper for bottles for containing gases or gases combined with liquids, such as aërated beverages, whereby an improved mode of filling, stoppering, and opening such bottles can be effected.—G. Campion. Harrows and such like implements employed in cultivating land.—F. G. Underhay. Bib-cocks or cocks for drawing off water.—O. A. Everett. Liquid meters (com.)—J. Baron, T. Richmond, and W. Richmond. Looms for weaving.—W. J. Curtis. Railway points or switches.—W. W. Dunn. Machinery for drilling or boring rocks and other hard substances, partly applicable to other purposes.

On February 9th.—504 to 515.—H. Chatwin. Finger boards, suitable for pianofortes, organs, harmoniums, and other such like instruments.—J. G. Tongue. Preservation of meat or animal substances (com.)—F. H. Atkins. Filters for ships' tanks and other purposes.—B. Blackburn and A. B. Blackburn. Apparatus for working steam engines expansively.—W. Gorton. [illegible]ing.—R. M. Marchant. Motive-power engines and apparatus connected therewith.—C. [illegible]. Apparatus for casting [illegible] [illegible] (com.)—E. Webb. Sewing machines (com.)—J. M. Adorno.

Railway and engines and carriages to be used thereon.—N. D. Spartall. Fire-places and cooking stoves.—L. F. Gosselin. Jacket or waistcoat for swimming and saving life.—W. F. Reynolds. Apparatus for indicating the speed of engines (revolution indicator).

On February 10th.—516 to 527.—V. Pendred. Boilers for generating steam. (Complete specification.)—J. B. Orr. Obtaining a white pigment, and the process employed therefor.—H. A. Bonneville. Fire alarm (com.)—C. H. Touaillon. Stopping teeth (com.) (Complete specification).—S. G. Cox. Pills.—F. Bale. Production of common salt.—M. McFeely. Process of combining "charger and heater" in the manufacture of spirits, to lessen the consumption of coal.—A. Lighbody and W. Lighbody. Lamp burners.—R. S. Gold. Hats.—J. Deléon. Building materials.—G. Hindley. Apparatus for cutting and dressing stone or other similar material.—D. Greig and M. Eyth. Machinery for towing by fixed ropes.

On February 11th.—528 to 535.—A. S. Wallis. Checking the amounts taken as fares by conductors of tramway cars, omnibuses, and such like public vehicles.—J. [illegible] Non-conducting composition [illegible] and J. Derihon. [illegible] or mastic for preventing the radiation [illegible] Robert Richardson. [illegible] of heat from boilers and other similar apparatus (com.)—J. T. Dann. Cooking utensils (com.)—W. Johnson. Apparatus for compressing air or gases.—J. H. Lynde. Tramways.—J. F. Wiles. Apparatus for propelling ships and other vessels.—M. Wilson. Stench-traps.—F. Render. Apparatus for elevating or transferring wheat and other such grain from ships or other vessels or from other situations.

On February 12th.—536 to 547.—J. Kiddill, jun. Fountain for use in game preserves, poultry yards, aviaries, and other places.—J. Harrison, W. Loynd, and R. H. Clayton. Air-pumps or vacuum-engines.—J. Campbell & W. C. Somerville. Mortar-mills or other grinding mills of a similar nature, and road rollers.—W. R. Lake. Apparatus for stretching boots and shoes (com.)—T. Blackburn. Manufacture of size.—B. Harlow. Potters' or earthenware printers' stove or hot-plate and method of heating the same.—L. H. Dethiou. Buckles without prongs, with a pressure in continuity through a movement of friction.—A. Allan. Stud or fastening for securing the ends of bale bands.—J. Hicks. Apparatus for saving life at sea.—J. Lobor. Machines for cutting paper and pasteboard.—J. T. Duncan. Precipitating metallic copper from its solutions, and obtaining a utilising material from the agent employed for the purpose (com.)—A. M. Clark. Clock (com.)

On February 13th.—548 to 558.—C. W. Vosper. Shuttles applicable to all kinds of sewing machines worked by a shuttle.—B. C. Lauth. Manufacture of cast-metal rolls, pipes, wheels, and other like articles, chiefly applicable to the manufacture of rolls and other parts of machinery for rolling metals (com.)—T. Perks. Brooches, shawl pins, nursery pins, and other like fastenings.—W. Buckingham. Heating apparatus for buildings, dwelling houses, also for steam-boilers or any such like purpose or purposes.—J. Goater. Arranging and combining the materials used in the manufacture and construction of fire and burglar proof safes, strong boxes, and other receptacles, and the parts connected therewith.—H. Pochet. Means and apparatus for shutting bottles, flagons, bidons, cans, &c.—A. Noble. Mode of giving rotation to projectiles and stopping windage in ordnance.—J. Clegg and R. Taylor. Mules and twisters for spinning and doubling.—W. B. Haigh and A. Blomby. Furnaces or cupolas used for melting iron and other metals.—W. C. Naugle. Composition and preparation of preservative and antifouling compounds or paints for coating metals and other substances.—J. J. Shedlock. Apparatus for containing pigments, inks, gums, and other like materials.

On February 14th.—559 to 574.—E. Meldrum. Open fire-places.—J. B. Dalzell. Signalling apparatus for railways.—N. Thompson. Means for stopping bottles, jars, and other hollow articles, which invention is applicable to means for connecting together tubes and other articles.—A. Smith and G. W. Hannam. Preparing peat for various uses and purposes by washing, straining, and precipitation.—C. A. Tetrey. Method of setting diamonds in drills and other boring and cutting tools.—J. L. Clark and E. J. Hill. Railway signalling apparatus.—F. Hazeldine. Valve or tap for liquids and other purposes.—W. W. Box. Apparatus used in the manufacture of gas.—W. Richards. Regulating the supply of fluids and liquids for the manufacture of illuminating gas, and for the apparatus employed therein.—A. F. Corbett. Production of artificial fuel.—D. Smith, T. Henderson, and W. P. Thompson. Apparatus for supplying fuel to steam boiler and other furnaces.—W. R. Lake. Paddle-wheels for steam-boats (com.)—H. S. Gregory. Seed and manure drills or distributors.—W. Palmer and C. Hopkinson. Flour-dressing by the use of improved mechanism.—M. Mirfield and J. Scott. Machinery employed for combing wool and other fibres.—J. Knowles. Machinery or apparatus for preparing cotton and other fibrous substances.

On February 16th.—575 to 584.—A. R. Burman and M. de Frece. Portable ether and perfume sprayers.—H. Aitken. Blast furnaces and cupolas, and recovering or collecting the products thereof.—R. Thornton. Construction of machinery for cutting corks.—[illegible] Preparing wool and other similar fibres for the combing process.—W. Clark. Invalid bedsteads (com.)—J. D. Napier and R. D. Napier. Winches and other hoisting or hauling machines.—J. Harvey and G. Pryer. System or method and means of applying, adapting, and setting sails for the better propulsion of vessels.—A. M. Dix. Methods of effecting locomotion, by which vehicles can be moved on common roads, tramroads, and railroads.—W. Needham. Method of signalling upon railways.—Sir D. L. Salomons. Mechanism or apparatus for indicating the speed of revolving shafts.

On February 17th.—585 to 600.—W. R. Lake. Rotary hay-tedding machines (com.)—H. Bradley. Tell-tale money-box.—G. A. Wilson. Rotary web printing machines.—D. Morton. Construction of the furnaces of steam boilers for the purpose of consuming smoke and economizing fuel.—W. Henry. Lighting and heating with carburetted hydrogen gas.—G. Ellison. Apparatus for communication between passengers, guard, and driver in railway trains, also the means of working the brakes for retarding or stopping such trains.—L. R. R. Comte de Beaurepaire de Louvagny. Purifying alcohol, and the apparatus employed therein.—G. H. Smith. Apparatus for clearing snow and other matters from tramways and railways (com.)—W. Clark. Steam and sailing vessels (com.) (Complete specification.)—J. H. Johnson. Application of heated air, and the machinery or apparatus employed therein (com.)—J. H. Johnson. Production of salicylic acid and of the isomeric and homologous acids (com.) (Complete specification.)—C. T. Wollaston. Railway recording apparatus.—F. Arnheim. Lithographic presses (com.)—E. H. Yarrow. Manufacture of gas, and the apparatus connected therewith.—S. de la G. Williams, jun., and H. Y. D. Scott.—Kilns for burning lime and cement.—R. Sanderson and A. Proctor.—Stoves, grates, or fire-places.

On February 18th.—601 to 621.—C. McBeath. Retorts and apparatus connected therewith, for the purpose of distillation and calcination of minerals, parts of which are applicable to other purposes.—G. Griffiths. Sewing machine shuttles and reels.—M. Baile. Multiple tool.—J. Kitchin. Boilers and steam generators.—C. D. Abel. Gas-motor engines (com.)—E. Hunt. Grinding mills (com.)—A. L. Fround. Method of domestic cooking, and improved apparatus and utensils to be employed therein.—F. Kemp. Coupling and disconnecting railway trucks.—J. T. Kirkwood and W. H. Smith. Treating metals by subjecting them to the action of gases charged with carbon, and apparatus employed therein.—J. T. Kirkwood and W. H. Smith. Treating metals by subjecting them to the action of gases or vapours, and apparatus employed therein.—J. Ruston. Apparatus for feeding thrashing machines.—C. C. Connor. Preparation of yarns and fibrous substances.—R. Long. Heating flat-irons for laundry purposes, and apparatus employed therefor.—J. F. Allen. Strengthening cannons and other cylinders. (Complete specification.)—J. Hynam. Cigar-lights, matches, and other similar articles, and wicks for lamps, candles, and other like articles, and apparatus employed therein.—S. Haley. Machinery or apparatus for splitting hides or skins.—F. Egerton. Mounting spindles to be used for carrying revolving brushes, drills, and such like, to enable them to be applied by hand in any desired direction.—I. M. McGeorge. Appliances for regulating the speed of steam and other like engines.—J. Toussaint. Moulds for casting metals and in castings for such moulds.—J. Keats, A. Greenwood, and A. Keats. Machinery for manufacturing boots and shoes, part of which is also applicable to sewing machines generally.—J. Tapping. Machinery for cutting or forming clay and other plastic substances into bricks, blocks, or slabs.

On February 19th.—622 to 642.—O. Siebert. Gas-light apparatus.—T. Clegg and T. Lucas. Arrangements for effecting the grinding of the travelling flats of carding engines.—H. Cockney and F. C. Cockney. Furnace doors.—J. J. Aria. Horse-shoes.—G. E. Whitmore. Purifying middlings. (Complete specification.)—W. Neuhoff. Bathing tubs.—E. T. Hughes. Breech-loading fire-arms (com.)—S. Leoni. Heating and cooking apparatus.—J. B. Terrace. Mechanism for working steam-engine valves.—A. R. Clarke. Washing machine.—J. Peel and S. Emsley. Looms and [illegible]—[illegible] Dawson. Dyeing and apparatus connected therewith.—A. Piver. Distillation of essential oils or perfumes.—B. J. B. Mills. Wheel-barrows (com.)—S. Lowe and S. White. Signalling on railways, especially during fogs and dark weather.—G. Rydill. Steam generators or boilers, furnaces and flues, water tubes and water casing applicable as a steam generator for marine and land purposes, to utilise the heat, and for other purposes.—G. Kent. Machine for cutting or slicing fruit, vegetables, and other matter also capable of being so treated (partly com.)—H. M. Mellor and L. Woodward. Rotary knitting machines.—W. H. Davies and F. H. W. Higgins. Electric telegraphs for giving signals and alarms.—H. Holland. Gas for illuminating and heating purposes.—T. B. Worrell. Bank locks (Complete specification.)

On February 20th.—643 to 656.—H. P. Trueman. Apparatus for measuring liquids.—H. A. Bonneville. Axle or spindle sole or socket (com.)—J. A. Jones. Sliding sashes.—W. Bywater and S. Smith. Apparatus employed in drawing, spinning, or twisting wool or other fibrous substances.—H. A. Bonneville. Fenders and protectors for vessels (com.) (Complete specification).—J. Peak. Combined system of weights, measures, and coinage.—H. I. Bageau. Waterproof compound for sizing and coating leather, wood, cloths, or other articles.—E. A. Clegg and A. Hoyle. Looms for weaving.—C. W. Collins. Combinations of mechanism for working the slide valves of steam engines and other motors.—J. Stenhouse. Manufacture of sugar and purifying saccharine solutions.—H. Y. D. Scott. Treatment of sewage and manufacture of manure therefrom.—A. Nitske. Cartridges.—J. Farmer. Machines for finishing printed sheets of paper.—J. Robinson and J. Smith. Machinery for shaping wood.

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On February 23rd.—669 to 688.—T. Vicars, sen., and T. Vicars, jun. Steam generators and self-stoking furnaces therefor.—G. F. Elder. Crisping or doubling textile and other fabrics, and the machinery or apparatus employed therefor.—J. Laird, jun., and W. Rutherford. Weaving bags, sacks, and other tubular and double fabrics, also single fabrics, and the means employed therefor.—H. Wilks. Steam boilers.—J. Baggs. Electric telegraphy and arrangement of apparatus employed therein.—J. Johnson. Bell castors.—J. Cottrell. Weaving ornamental fabrics.—R. S. Harvey. Privies and dry earth closets.—S. Newton and C. Newton. Puddling furnaces used in the manufacture of iron and steel.—H. B. Barlow. Brewing and machinery

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Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE.

JUNE 1, 1874.

SCHOOL BOARD MEDDLESOMENESS.

"Save us from our friends" is an aphorism the truth of which receives fresh confirmation with our increasing experience of life, and certainly the present position of public elementary education in this country is another proof of the verity of this old saying, for the modern friends of education of the people are now so *thorough-paced* that they are determined everybody shall be educated according to the one routine they have settled as being the right one, and any other they will ~~drive out of the~~ land, if they can possibly manage it.

As may naturally be supposed, we feel the deepest interest in the cause of true education, and are anxious to do everything we can to aid in so expanding the machinery of popular instruction that hereafter every child, of whatever birth and parentage, shall be as well instructed in the elements of learning as the mental capacity of each child will allow, and further that those children who show decided aptitude for higher instruction shall be helped forward in their educational career; for we believe that the good of society and the prosperity of the country need the aid of the talents of every one, and that without a sufficient educational training talents will seldom, if ever, be satisfactorily applied.

But with all possible good wishes for the general spread of education, we cannot support the views of those who think it necessary for a certain quantity of book learning, and of one particular form, to be *nolens volens* crammed into the brain of every individual. Doubtless we ought to use all reasonable endeavours to secure for every child in the kingdom the possession of a passable acquaintance with reading, writing, and arithmetic, for these are, so to speak, the tools used in intellectual culture, but that this can only be done in a given number of years, in very early life, and on one plan only, we hold to be an utter absurdity; and we cannot allow that the education which shall be truly useful to the individual or the community at large should be restricted to book knowledge, for a person imperfectly acquainted with book lore whose observant faculties are quick and retentive is likely to be far more useful in the work-day world—aye, even the world of science—than one with better formal education and the dulled perceptions of the beautiful and the useful, which too often result from the continued compulsory use of the school form which many unfortunate children have to undergo; for, be it known to our educational enthusiasts, there are such beings as learned *fools*. Again, for most of us, a perfect knowledge of some art or trade is of far more importance than profound knowledge of grammar, history, or any of the "ologies."

In truth, the education which is to be worth having must take a wider range as to subjects, and be liable to less restriction as to the mode and time of inculcation than its professed friends in modern days seem willing to admit. Moreover, educational systems must not rely upon compulsion, but must stimulate by dealing out the "reward of merit" with a liberal hand.

For our part we consider it a very unfortunate matter that Government has been compelled to interfere with education at all, since everything, as we all know, which falls under its control, is almost certain to be carried out in a procrustean manner, and this, when applied to education, is as fallacious a plan of action as can well be conceived, for the varying dispositions and tastes of individuals make it necessary that modes of education should be not uniform but various: unless, indeed, one dead level of mediocre intelligence is the thing to be obtained, which we must confess ourselves opposed to. Our modern educationalists, however, think otherwise. Uniformity with them is everything, and they are, it seems, determined, if they can, to destroy the liberty we possess of adopting different methods in the teaching of youth, and in proof of their disposition to meddle with our freedom in this way reference to the reports of the religious squabbles of the School Board may be mentioned; but more direct evidence will be found in the cases reported in the daily journals in regard to the doings of the officers of the London School Board, which lead us to think that an educational dictatorship is intended to be established which shall crush out of existence all our private schools and home tuition.

We are too well aware that tyranny is an almost inseparable concomitant of power, especially when power is entrusted to officials of inferior grade (and to the truth of this the numerous complaints of abuse of authority by the police sufficiently testifies), to be surprised at any petty tyranny that may be exercised by Jacks-in-office under the plea that they are strictly fulfilling their duties, and we are not astonished at finding that the magistrates often treat complaints against inferior officers of law and government in a very cavalier fashion. But with all our knowledge of these things we are free to admit that we were not prepared to find that, in the first place, the School Board had appointed officers to arrest the children of decent citizens evidently on their way to or from school, and make them undergo an inquisitorial process; and then that the magistrates seem to think this the right thing to do. Surely, if the number of Government schools erected, or being erected, exceed the requirements of the hitherto wholly uneducated classes, they could be filled by making them superior to to the lower class private schools; and the Board need not set up for the supreme arbiter of education and allow none other than that which is given under its direction. As our readers may possibly consider these remarks too trenchant, we present them with the following statements of two cases reported in the public journals.

Not long ago Mrs. Mitchell, a lady keeping a middle-class school for the daughters of tradesmen, applied at Bow-street Police Court to Mr. Flowers, the sitting magistrate, stating that she had been a school-mistress for many years, and had been very successful with her pupils, who were taught French, German, and music at her school. She was, however, not directly under the control of the School Board, and in consequence of that the School Board officers had threatened the parents of her pupils with legal proceedings in the event of their daughters remaining at her school. Several of her pupils had already left in consequence of this, and she was afraid that several more would follow their example. More recently Miss Thompson, the keeper of a private school at Half Moon-crescent, Islington, attended before Mr. Cooke, magistrate at Clerkenwell, to complain of the conduct of Mr. Bates, one of the visitors of the London School Board, Finsbury division, under the following circumstances. She stated that Mr. Bates was in the habit of stopping persons and children who were on the way to her house, and openly telling them that her place was not a fit one to send children to. Mr. Cooke said the officer had *a perfect right to stop the children* and obtain their names and addresses. That was part of his duty. If the applicant had sustained any damage through what the officer had said she could bring an action in the County Court against him, and *if she sustained her case* the judge would award her ample damages.

That these are not mere Dogberry and Verges freaks, but part of a systematic onslaught by the School Board on independent private schools, will be evident from the report of the case in the *Daily Telegraph*, of 15th April last, of Mr. Webb, of Underwood-street, City-road, who was summoned to answer for not sending his little daughter to school, and he answered this complaint by stating that he did send his child to school; to which plea the School Board officer rejoined that this school was not an efficient one, and his *ipse dixit* Mr. Bushby, the sitting magistrate, seemed to think sufficient to settle the case. Other cases have been brought before the magistrates where the children have been under instruction at private schools or at home, but in all of them the same view of School Board authority has been adopted; so that it is evident, that parents, if not of such high position in life as to be unapproachable by School Board beadles, will have, in order to escape the unpleasantry of being "brought up at the police-court," to send their children to the School Board schools—where the question of religious teaching is in a state of unsettlement, and parental influence over mental culture is ousted. And this, which will be an illegal and unnatural usurpation of power over education we consider, will have a prejudicial effect in stunting youthful minds, and lead to the indefinite increase of local taxation.

Reviews.

MARINE BOILERS AND FURNACES.

"On the Principles of Combustion and Efficiency of Marine Boilers and Furnaces." By N. D. SPARTALI.

THIS pamphlet, after thoroughly discussing the philosophy of combustion, and showing that boilers on nearly all known constructions are (as every one knowing anything of the matter will readily admit) very imperfect, goes on to state that the writer has modified the present marine boiler by adding a second combustion chamber on the other side of the fire tubes, and by placing therein a small additional fire grate (at the front side of the boiler, just below the uptake), which, he says, to use his own words, I also raise to a good height over this combustion chamber leading to a small funnel—the heat and flame of this furnace will meet and catch the fumes and flames from the main furnace through the tubes, and set the smoke and gases into a continuous flame [illegible] cause an even distribution [illegible], and thereby out. I have also add[illegible] of heat through- [illegible] to the model a plan for carrying over the flames ignited gases, from the second combustion chamber and furnace into a second upper series of tubes, into the other side of the boiler, right over the first combustion chamber, which is separated by a diaphragm, forming part of the boiler and containing water. By this concentration of heat into one body of water a greater evaporative power and steam of a greater pressure will be obtained and maintained at much less fuel than the present extravagant system of spreading the heating surface, increasing the number of boilers into as many as twelve, in some of the Atlantic steam ships professing to be working at the highest efficiency. Boilers, on this principle, will be able to work steam at 150 lbs. pressure per square inch, or equal to double the present nominal H.P at same expense of coal. They are now getting a bare 70 lb. pressure. In fact, by careful calculation, I find they are burning as much coal to reproduce 90 of heat (from 212° to 302°) that is lost through the condenser by the energy exerted by the engines) as if they were raising the temperature of the water from 50° to 212°, and I may be pardoned humbly to ask what can be the use of the surface condensers if they cannot maintain the bulk of the water in the boilers up to at least 212° constant?

I have also planned some oven boilers of moderate size, with double furnaces cased in iron frames, constructed of special metal and workmanship intended for higher pressures. These, as well as the modified present boiler as explained above, will be of such a size and construction, with due regard to bursting pressure and tensive strength, consistent with safety, to the available means for cleaning and repairing, and for the perfect and even circulation of the feed water. Boilers of too small a size for marine purposes are highly dangerous, owing to the scaling by the salt, and by the uneven expansion caused by the irregular circulation of feed water, and consequent overheating of the part of the tubes or plates, resulting often in explosion by action of the hydrogen gas contained in the boiler in contact with the oxide of the iron, causing chemical decomposition thereby, particularly where there is the least contact with air through any small oozing or leak.

In addition to the advantages herewith fully explained by the complete combustion and utilization of the fuel in boilers, I have found it to be a great advantage in using, with enclosed furnaces, a combination of silica and allumina composite matter as an auxiliary to coal fuel. This does not generate heat of itself, but being capable of absorbing an intense heat, and being of the same specific heat in fact as the coal itself, it will retain nearly half of it when the coal is gone into ash, and, by the addition of a very small quantity of fuel at a time a furnace may be kept up at a very high temperature, particularly when a blow of air pressure is used as an auxiliary. For domestic purposes I have used the same for now nearly one year with the best result in combination with coal in a semi-closed fire grate of my own invention, which can be made to the shape and size of any ordinary fire grate. The combustion affected in this little furnace sending 10° to 15° of heat into a room of nearly 4,000 cubic feet, is at a cost of less than 1 lb. of coal per hour, and as little as 12 lb per 16 hours against 30 to 40 lb. according to the old system of firing.

My claims to the mode of combustion proposed, and by allowing as little escape through the chimney as possible, which I regulate by deflectors or dampers, are as follows.—Independently of the full value of 1 lb. of coal obtained, the advantage of heating the air in the furnaces, by the introduction of a moderate air blast, will be obvious by the increase of the volume of the gases [illegible] or, as explained by [illegible] the tables, and by the rapid elevation of temperature in the furnaces—a most essential point in the successful working of high-pressure steam, and finally in the reduction of the number of furnaces, resulting from the increased volume of total heat as compared to the total mass of coal supplied.

PROCTOR'S UNIVERSE AND THE COMING TRANSITS.

"The Universe and the Coming Transits, presenting researches into, and views affecting, the Constitution of the Heavens; together with an Investigation into the coming Transits of Venus. Recently Confirmed by an Unanimous Vote of the Chief Astronomers of Great Britain." By RICHD. A. PROCTOR, B.A. (Camb.), Hon. Fellow King's College, London, formerly Secretary, R.A.S. London: Longmans, Green, and Co. 1874.

MR PROCTOR'S reputation as an astronomer of the highest eminence is scarcely superior to his ability to afford information on astronomical subjects in manner to be "understanded of all men" who will give their minds to their consideration; and the volume before us is an apt illustration of the author's power of conveying the results of profound scientific research in an easy, perspicuous style.

The work contains two series of essays; one series relating to the Universe, the other to the approaching transits of Venus. And Mr. Proctor says:—

The essays on the Universe present, very nearly in chronological order, my researches into and gradually advancing views respecting the constitution of the Universe. With the exception of a few papers which have appeared in my "Essays on Astronomy," all my original researches into this subject are given in the present volume.

I believe that my account of the results obtained by Sir W. Herschel during his long and arduous labours in the study of the star-depths is more accurate than any yet presented.

In this volume I give full copies of all my maps and charts of the star-depths, except in the case of my large chart of 324,000 stars, sections from which only are given.

Plate VII. is by Mr. Sidney Waters, F.R.A.S., and is, in my judgment, a most valuable contribution to uranography.

The essays relating to the transits of Venus present the whole of my more strictly scientific discussion of that subject, as well as all the charts which I have drawn at different times to illustrate it. It has seemed to me desirable to publish these papers and charts in a collected form; because while American, German, French, and Russian astronomers have published very excellent and complete series of charts illustrating the transit of 1874, no British series has been published, nor has any student of astronomy in Great Britain, except myself, undertaken the thorough investigation of the conditions of the transit of 1874. In saying this I am not, on my own authority, undertaking to describe as insufficient the Astronomer Royal's investigation published in 1868. He himself, in a letter addressed to me in 1869, described that investigation as rough, and in fact merely preliminary. Nor in presenting my own results as accurate am I claiming for myself more than others have allowed. The Astronomer Royal, in a letter read before the Council of the Astronomical Society on January 10, 1873, when as yet little more than half the series now published was completed, spoke of my investigation as "probably the best yet made;" and as is now well known, every one of my suggestions has been adopted—except one, *made* in good time, but renewed unfortunately (so anxious was I to avoid undue haste) too late—I mean the suggestion that reconnaissances should be made in the Antartic and sub-Antartic Seas, to ascertain what places, if any, are suitable as additional southern stations for observing the [illegible] 1874 transit of [illegible].

It would be difficult, without presenting our readers with a complete *résumé* of the work to give anything like a worthy notion of it, and even then the numerous illustrations and maps which accompany the text would be required to be placed before the reader. Hence we refrain from further quotation, and refer all interested to the work itself.

GOODEVE ON MECHANICS.

"Principles of Mechanics." By T. M. GOODEVE, M.A., Barrister-at-Law. Lecturer on applied mechanics, at the Royal School of Mines. London: Longmans, Green, and Co. 1874.

THIS forms another of the valuable educational books, issued by Messrs. Longman.

The work contains an outline of one part of the course of lectures on applied mechanics, given by the writer at the School of Mines, and to those interested in the study of mechanics, we recommend the perusal of it.

NASMYTH AND CARPENTER ON THE MOON.

"The Moon: considered as a Planet, a World, and a Satellite." By JAMES NASMYTH, C.E., and JAMES CARPENTER, F.R.A.S., late of the Royal Observatory, Greenwich. With twenty four illustrative plates of lunar objects, phenomena, and scenery. Numerous woodcuts, &c. London: John Murray, Albemarle-street. 1874.

THIS work may fairly rank amongst *chef d'œuvres* for we can truly say that it is long since any work on science has issued from the press which equals this one, not only as regards reliableness of information contained in its pages, but also in respect of the beauty and correctness of the illustrations, the mode by which the excellent series of illustrations were produced resulting in a delightfully correct picture:—Mr. Nasmyth, not content with the drawings he had accumulated for many years, and in order to present these illustrations with as near an approach as possible to the absolute integrity of the original objects, translated the drawings into models which, when placed in the sun's rays, would faithfully reproduce the lunar effects of light and shadow, and, by photographing the models so treated, faithful representations of the original were reproduced, and the result is in every way highly satisfactory. The text is quite on a level with the illustrations. Thus we have here a work that commends itself to all students and admirers of astronomy and science in general, and to such it will be of especial value, though it can be read with advantage and instruction by those who have no special aptitude for scientific research.

The first three chapters of the work deal with the cosmical origin of the planets of the

solar system, the generation of cosmical heat, and the subsequent cooling of the igneous body. Then the consideration of the questions particularly connected with the moon may be said to be commenced in the fourth chapter, which deals with the form, magnitude, weight, and density of the lunar globe, this chapter being summed up by giving the facts on which the data is based, which we reproduce as we feel it might prove interesting :—

	That of Earth.
Diameter of the Moon 2,160 miles	$\frac{1}{3\cdot67}$
Area, 14,657,000 square miles	$\frac{1}{13\cdot45}$
Area of visible hemisphere, 7,328,500 square miles.	
	That of Earth.
Solid contents, 5,276 millions of cubic miles	[illegible]
Mass, 73 trillions of tons	$\frac{1}{80}$
Density, 3·39 (water = 1)	0·62
Force of gravity at surface............	$\frac{1}{6}$
Mean distance from earth, 238,790 miles.	

In chapter V. is considered the existence or non existence of a lunar atmosphere, and on this question we doubt not that the authors will find many who disagree with them as to the possibility of non-existence of an atmosphere round the moon. The authors give various and very forcible reasons for their views as to the non-existence of a lunar atmosphere, and we cannot do better than quote from their book one of their reasons for arriving at that conclusion :—

The probable existence of an atmosphere used to be inferred from a phenomena seen during total eclipses of the sun. On those occasions the black body of the moon is invariably surrounded by a luminous halo, or glory, to which the name "corona" has been applied ; and, further, besides this corona, apparently floating in it and sometimes seemingly attached to the black edge of the moon, are seen masses of cloudlike matter of a bright red colour, which, from the form in which they were first seen and from their frame like tinge, have become universally known as the "red flames." It used to be said that this corona could only be the consequence of a lunar atmosphere lit up as it were by the sun's rays shining through it, after the manner of a sunbeam lighting up the atmosphere of a dusty chamber ; and the red flames were held by those who first observed them to be clouds of denser matter floating in the said atmosphere, and refracting the red rays of solar light as our own clouds are seen to do at sunrise and sunset.

But the evidence obtained, both by simple telescopic observation and by the spectroscope from recent extensively observed eclipses of the sun, has set this question quite at rest, for it has been settled finally and indisputably that both the above appearances pertain to the sun, and have nothing whatever to do with the moon." This gives one out of many reasons for the views held by the authors, and the result, according to their views, "that all the evidence we have is summed up at the end of the chapter goes to prove that neither air nor water exist upon the moon," and that "in considering the causes that have given birth to the diversified features of the visible surface of the moon, we may therefore ignore the influence of air and water action, and confine our reasoning to igneous phenomena alone.

In chapter VI. the aspect of the lunar surface is considered, and this aspect under varied powers of telescopes ; and, in the next chapter, a very interesting topic is dwelt upon, viz., the typography of the moon, and this is very lucidly explained in various ways by which ultimately the mapping of the moon has been accomplished.

Our space does not permit of our treating on the subject of the next three chapters, which refer to the grandest aspect which the moon presents in the vastness of its craters, the volcanoes on our earth being of the utmost insignificance in comparison. The remainder of the work treats of the moon as a world and as a satellite, but although we could present our readers with passages even more interesting than those already given, space compels to refrain from doing so.

THORPE'S QUALITATIVE ANALYSIS.

"Qualitative Chemical Analysis, and Laboratory Practice." By T. E. Thorpe, Ph.D., F.R.S.E., Professor of Chemistry, Andersonian Institution, Glasgow ; and M. M. Pattison Muir, F.R.S.E. London: Longmans, Green and Co 1874.

We have so repeatedly spoken of the excellence of the series of text-books now being issued by Messrs. Longman, of which the work under notice forms one, that all we can say of this work is that it fully sustains the high character of its predecessors for the sound matter and clear intelligibility with which important information is conveyed. More particularly as to the present work, we have to remark that it is written in such a style that the various operations of qualitative analysis are conveyed in a concise and clear form that adapts it to the wants of those who are not deeply versed in the science of chemistry, and without that clouding with formulæ which is generally found in works written presumably for the same class, which, as far as our experience goes, have proved more a bar than a help to the student.

This work is divided into two parts. In the first part, the student is instructed to perform a series of experiments in order to familiarize himself with the leading properties of non-metallic elements, and the principal substances which they form by their mutual union.

The experiments are generally of a very simple nature, and at the end of each lesson is a short statement or summary of the facts which the lesson is intended to convey. This last we think a very excellent course. The second part treats of qualitative analysis, being divided into five sections, each section treating of different modes of testing.

We think that the efforts of the authors have been accomplished, in their endeavour to make the book very practical, and within the scope of a student of ordinary intelligence. We cordially recommend it to every student and others interested in the study of chemistry.

ELEMENTARY SCIENCE MANUALS.

"Geology." By T. G. Bonney, M.A., F.G.S., &c. Fellow-Tutor and Lecturer in Natural Science, St. John's College Cambridge.

"Physiology." By T. Le Gros Clark, F.R.S., Surgeon to St. Thomas's Hospital. London : Society for Promoting Christian Knowledge, 77, Great Queen-street, Lincolns Inn Fields.

In the present day when the cry for technical education, and teaching of science in our elementary schools, seems to be echoing on every side, it is no wonder that books on the various sciences, both good, bad, and indifferent, are being showered down upon us with extraordinary rapidity, though we cannot say that we can commend what appears to us to be a perfect plethora, especially when we consider what proportion of them are of that character, that instead of doing any good do infinite harm to students. Being for the avowed purpose of facilitating passing at a particular examination, they are sought after, and, by reason of this much-to be regretted system, things are crammed into a student's mind; so that instead of giving him a clear insight into the various elementary principles of the science he is anxious to have, he gets a mere smattering, which probably he would have done well to have left alone. Again, in consequence of the multiplication of these works it is difficult for teachers and students to settle which is the best work to use. However, if we allow that any necessity exists for the publication of the works under notice, we should say that no better books on elementary science could be written, the high reputation of their authors as men of science being well sustained by the character of the contents of the works.

FLINT AND ALLIED BODIES.

"The Nature and Formation of Flint and Allied Bodies." A paper read before the Geologists' Association, January 2nd, 1874. By M. Hawkins Johnson, F.G.S. George P. Bacon, Lewes.

This pamphlet is in support of the author's theory, which is as follows :—

Flint is an organic structure,—which has undergone at least two very remarkable changes. The first is the substitution of silicon, at some stage of its decomposition, for its carbon, resulting in the production of silica, the binoxide of silicon, as an ultimate product, instead of carbonic acid, the binoxide of carbon. The silica thus formed being a stable, solid, crystalline substance, in lieu of a gas, like carbonic acid, the form of the original body is retained.

The second change, is the infiltration of this siliceous structure with dissolved silica, and the crystallisation of this silica in its interior.

As these propositions, says the author, are not likely to be received without opposition, I shall endeavour to anticipate, as well as I can, the objections that are most likely to be made.

This opposition is combatted in a way well worthy of the attention of geologists and chemists.

PEAT FUEL MACHINERY.

Mr Joseph McCarthy Meadows read at the last meeting of the Session 1873-74 of the Institution of Civil Engineers the following paper, which was directed to the consideration of points of difference in construction and arrangement in some examples of peat machinery which had been examined by the author. The mechanical systems in use were classified into the wet process for densifying, and the dry process for compressing peat. The wet process macerated or mixed the raw peat, and for that purpose mechanism of the pug-mill class was usually employed. Of existing machines those of Schlickeysen, Rahder, and Clayton were referred to. In the Schlickeysen, or chief German Machine, the two-fold work of mixing and of forcing out the peat as a pulp under a moderate pressure was effected by one operation of the arms or blades on the upright shaft of the mill ; while in the Rahder, or Dutch machine, the mixing and forcing were separate operations. The upper part of the Rahder pug-mill contained the vertical shaft, the arms of which simply mixed the peat, while in the lower part the pulp was forced outwards, under a moderate pressure, by a short horizontal screw or spiral. The same two-fold action to some extent characterised the Clayton machine, with this difference, that the action of the screw or spiral was principally relied on, in combination with fixed cutters in the inside of the casing, for a fine comminution of the peat. The author was, however, of opinion, that a rough effective mixing of the raw material was sufficient for making good dense peat, and that in practice mechanism for fine comminution was not desirable. The German and Dutch machines were stated to be capable of mixing and delivering, singly, about 60 tons of wet peat for each full working day, which quantity, when in usual air-dried state, would give from fourteen to fifteen tons of dense peat fuel ; and practice had shown that a single machine, upon the pug mill principle, could not be economically or usefully [illegible] much larger production. The machine of Clayton had not yet been [illegible] by working results of sufficient length spread over one or more full seasons, and [illegible] the average capability of production were wanting. The proportion of water in peat was upon the average 80 per cent., and the treatment of 60 tons of raw peat in one machine in

twelve hours, would represent its mixing and delivery in the state of pulp at the rate of about 230 cubic feet per hour. Working arrangements were either fixed or transportable; of the latter kind the Radher machine was instanced as a useful example. The author thought that the principle of transportability, by which the mechanism should constantly follow the excavation, was an essential requisite of commercial success where an extensive tract was to be worked. In the Radher system, the mills, with their portable engines (each from 6 to 8-horse power), travelled on rails laid temporarily alongside the line of excavation, and were thus kept close to the raw material which would otherwise, if the machinery were fixed, have to be moved with its 80 per cent of useless water to the place of manufacture. The same principle of transportable mechanism was carried out in extensive peat works in Bohemia. Eichorn's system of making ball turf by the wet process was next described, specially with a view to illustrate the application of fixed lattice frames for drying the peat balls. For each Clayton machine nine thousand wooden trays were stated to be necessary for the drying; and the systems of Eichorn and of Clayton in this respect represented two distinct modes of arrangement.

Mechanism for disintegrating raw peat by rollers or cylinders armed with teeth or points was next referred to. In some instances the functions of machines of this kind were simply confined to producing pulp from peat without delivering it in shape. The mass of pulp was in such cases spread on the drying ground and divided into pieces by hand. Challeton's system, by which raw peat was reduced by copious addition of water into a thin fluid state, in which condition it flowed into shallow basins for filterage and partial drying, was next described, but the principle was not thought to be conducive to economic production. The extent of shallow reservoirs that would be requisite, and which, unless roofed over, would be available only for the few fine months of the year when peat could be made in the open air, did not constitute an improvement.

Exter's system for making compressed peat by the dry process was next detailed. The peat was obtained in a fine condition by a thin slicing of the surface of the bog, partly dried in the open air, and finally by artificial heat, and was then compressed by direct mechanical force, by iron rams or plungers, worked by steam power, from eccentrics.

In reference to the production of dense peat by the wet process, it was stated that on the Continent, in 1872, the cost varied from 6s to 7s. per ton. With the present prices of labour in this country, the author thought the cost, when spread over a full year's expenses, could not be safely estimated at less than from 7s. to 8s per ton. Economies might hereafter reduce the cost from 6s 6d. to 7s per ton, but not to less, and estimates based upon lower rates were, in the author's opinion, not reliable. As compared with an average of four varieties of German coal, the heating power of peat was stated to be about 60 per cent. that of coal. This result was arrived at in practice in Southern Germany, where peat was largely used for locomotive purposes, and in this respect, weight for weight, light fibrous peat gave as good a result as dense or compressed peat, the advantages of the latter consisting solely in the reduction of bulk and the concentration of the original quantity of peat in a smaller space. The economic worth of that reduction was, practically, the measure of the increased value given by mechanical systems to peat. The author thought that, in the vicinities of bogs, where the use of peat in its ordinary condition of cut turf had been established, changes were not likely to be made in the regular mode of preparation for local purposes; but if markets could be profitably opened for peat fuel at a distance, the reduction of its bulk would become of importance. As dense peat made by any system of the wet process gave, when charred, a firm charcoal, which was not obtainable in compact condition to the same extent from peat simply cut and dried, the author thought - looking to the great stores of coal in Great Britain—it was in that direction most hope lay for the advantageous application of mechanical processes. He supported this view by stating that in most cases abroad the adoption of mechanical systems might be traced to necessities which had arisen either from inferior character or local circumstances in connection with peat deposits there, which did not exist to the same extent in the deposits of peat of superior class which were found in these countries.

The paper closed with particulars of some laboratory tests, carefully conducted by Professor Galloway, of the Royal College of Science for Ireland, to ascertain the absolute heating power of peat. Three samples of dense peat made from the upper, the middle, and the lower portions of an Irish red bog, were used—each being in the best possible air-dried state. No. 1, from the upper fibrous portion of the bog, had a specific gravity of 0·637, weighed 39 81 lbs to the solid cubic foot, and gave an absolute heating power, by Thompson's instrument, equal to 6·05 lbs. of water at 212° F., converted into steam by 1 lb Sample No. 2, from the middle of the same bog, had a specific gravity of 1·000, weighed 62 50 lbs. to the solid cubic foot, and gave an absolute heating power equal to 5·60 lbs., of water at 212° F., converted into steam by 1 lb. Sample No. 3, made from the lower portion of the same bog, had a specific gravity of 1 173, weighed 73 31 lbs. to the solid cubic foot, and gave an absolute heating power equal to 6·33 lbs. of water at 212° F., converted into steam by 1 lb. Although differing in relative densities, the heating powers in respect of equal weights did not materially vary. When compared, however, in respect of their relative bulks, one cubic foot of No. 1 peat would be found to give an absolute heating power equal to the conversion of 240·87 lbs. of water at 212° F. into steam; while Nos 2 and 3 would give respectively 343 75 lbs. and 464 07 lbs. of water converted in like manner into steam, from 212° F., for one cubic foot of each.

REPORT AND PROCEEDINGS AT THE INSTITUTE'S ANNUAL MEETING.

The Annual General Meeting of the Inventors' Institute, for the year ending May, 1874, was held at 4, St. Martin's-place, Trafalgar-square, at four o'clock p m., on Thursday, the 14th May, 1874, when Marshall Mason Harris, Esq., Member of the Council, was unanimously voted to the chair. In opening the proceedings, he adverted to the fact that the Institute had now arrived at a period of its history when an opportunity seemed to present itself for its marching forward to achieve great things for the inventors' cause, and he trusted that the members would not forget this in dealing with the arrangements to be made for carrying on the business of the Institute for the future. They had in the Chairman of the Council, Sir Antonio Brady, one who, when absent, was as much interested in the prosperity of the Institute as when present. Captain Selwyn, also, they all knew as an able and earnest worker on behalf of the inventors' cause, and their own intelligence and activity, backed by such men and aided by such officers as the late lamented R. M. Latham, Esq., Mr. Campin (the present secretary), and the present auditor (Mr. Carttar), ought surely to secure for the Inventors' Institute a large measure of success; but he would just remark that self-congratulation would not effect this; there must be active interest evinced by the great body of the members, and last, though not least, the subscription list must be well kept up to the mark, for money was the "sinews of war." With these remarks he would call upon the Secretary to read the report of the Council, which would give them a general review of what the Institute had done during the past year, and afford them information of what it proposed to do in that upon which they were entering.

The Secretary then read the following:—

REPORT OF THE COUNCIL OF THE INVENTORS' INSTITUTE.

The Council of the Inventors' Institute, in presenting the twelfth annual report, have to congratulate their fellow-members on the fact that during the past year work of great importance has been accomplished, for not only have the subjects brought forward at the members' meetings been of a more than usually interesting and practical character, but the discussions have been well sustained, leading to full examination of the topics brought under notice thereat.

And, beyond this, the past year has been signalised as one in which Patent Law amendment has received considerable advancement.

Since the last annual report the Council has been in a position to present the members of the Institute with the decisions arrived at by the sub-committee for considering the propositions of the last committee of the House of Commons on the Patent Laws which, as reported in the Journal of the Inventors' Institute (Scientific and Literary Review) for January and February, 1874, show a concurrence in the advisability of the various improvements in the organisation of the Government Patent Office proposed by the House of Commons Committee, and suggest that the cost of patents should be reduced to the extent of one half of the present fees and stamp duties at least, with the addition of very valuable observations as to the soundness of some of the views put forward by the House of Commons Committee on this question.

The advent of a new Parliament and new Government, it was considered, made the present time one that, under all the circumstances of the case, might be considered a crisis for the Patent Law question; hence it seemed very desirable that full and decided expression of the views of the whole body of members on the subject referred to should be obtained so that the Council might find itself prepared for immediate action of a satisfactory character, and it therefore determined to hold conferences with the members at large on the subject of the Patent Laws, and issued notices to all of them requesting their attention to this matter, and asking their consideration of the proposed Invention Right Bill, published in the Institute's Journal (the Scientific Review) for July, 1871, and the abstract thereof published in the same journal (the Scientific and Literary Review) for September, 1872; also to the articles Nos. 1 and 2 on "Revision of Parliamentary Report on Patents," in January and February in the present year, and such notice stated that the special points for consideration were:—

1. A large reduction in the cost of letters patents, one-half having been suggested.

2. Amendment of the procedure for obtaining letters patent.

3. General reform of the Patent Office and Patent Museum arrangements.

4. Amendment of the legal procedure for repression of infringements, and of unwarrantable assumption of patent rights so as to render the same more certain and less costly.

Each member was informed that it would greatly facilitate the object in view if only he would kindly communicate his views as

to what importance he attached to these points, and what he considered to be the relative value of each point, that is, whether the first or any other is more pressing for amendment than the others.

These conferences were held on the 19th of March and 2nd of April last, at the first of which Sir Antonio Brady presided over a very full meeting, and at the second (that of 2nd of April), after reading communications in writing addressed to the Council by many members of the Institute, and fully discussing the question, especially in regard to the proposition that had been made for compulsory licences (on which much difference of opinion was evinced), it was proposed by Mr. Newton Wilson, a member of long standing, seconded by Mr. William Yates, C.E., and carried unanimously, that in order to give effect to those views of the members which had been expressed in favour of the amendment of the Patent Laws so as to afford inventors *cheaper* and *more protective Patents* "that the Council be recommended to apply to the Government at an early date soliciting that Legislative action be taken for the amendment of the Patent Laws."

Acting on this resolution the Council have taken the matter into consideration, and have directed the Secretary to ascertain the right Member of the Government to apply to, and he has reported that the Prime Minister, Chancellor of the Exchequer, and the Lord Chancellor should be applied to in the first instance.

Besides this direct action on the main question of Patent Law amendment, the Council have to report that at the International Patent Congress at Vienna the inventors' interests were very warmly advocated by the Honorary Commissioner of the Inventors' Institute, and the Congress being presided over by C. W. Siemens, Esq., F.R.S., D.C.L., &c., a member of the Council of this Institute, the attempts made to emasculate the patent system, if not to overthrow it altogether, were happily defeated.

The proceedings at the Vienna Congress will be found reported in the Institute's Journal (SCIENTIFIC AND LITERARY REVIEW) for September, 1873.

As it was found that the British Association for the advancement of Science would, at the Bradford meeting, in September last, take into consideration the Patent Law question, the Council determined that the Inventors' Institute should, if possible, be represented thereat; and Mr. F. H. Varley, the Chairman of the ordinary Council (or Executive), was solicited to attend that meeting, which, however, he was unfortunately prevented from doing. But though the loss of his advocacy was much to be regretted, the Institute found, in one of its members, who was also asked to represent the association at that meeting (and who, from being a local resident, was able readily to do so) that it had secured an able advocate who was a host in himself; that gentleman being S. C. Lister, Esq., of Manningham Hall, Bradford, and Leeds, a name well-known amongst inventors and manufacturers. What passed at Bradford in regard to the Patent Laws the members will find narrated in the number of the Journal (SCIENTIFIC AND LITERARY REVIEW) for November, 1873.

The Social Science Meeting at Norwich also promised a favourable opportunity for ventilating the question of Patent Law amendment; hence the Council determined to invite one of the members of the Institute, namely, I. Evans, Esq., engineer of the Gas Works, Norwich, to represent it thereat, and his ready compliance the Council gratefully acknowledge, though the discussion of the question was postponed.

The Chambers of Commerce have moved in the question of International Patent Right, and, here again, the Institute has had the good fortune of finding that part of its work well performed by some of its members, namely, Sampson Lloyd, Esq., M.P., member of the Council, Mr. Lister, already named, and Mr. Somerset Mackenzie, a gentleman well-known amongst shipowners.

Sir Antonio Brady, our chairman, Mr. Siemens, and other gentlemen connected with the Institute, have given their attention and assistance to a movement in favour of reorganising the Patent Museum, a very important matter for inventors and patentees, though one that in strict justice ought, as far as expenditure thereon is concerned, to be a matter for the ordinary revenue of the country to provide for. The Council would suggest that aid be given to Sir Antonio in his efforts in this direction, so that a satisfactory system as to the Patent Museum may be attained to without specially taxing the inventor.

With regard to the papers read at the Members' meetings, which have been before adverted to, the Council feel bound to signify their approval of those:—

"On Bogs and their Utilization for Peat Fuel and other purposes." By Peter Love, Esq.

"On the Economic Use of Gas for Heating and Cooking." By E. R. Southby, Esq., M.R.C.S. Inventor, Mr. Southby.

"On Prevention of Railway Accidents by Automatic Railway Couplings." By W. Gadd, Esq., C.E., Manchester. Inventor, Mr. Green.

"On Communication Apparatus for Railway Trains." By C. Fox Roe, Esq. Inventor, Mr Stapleton.

"On Suppressing Fires by Novel Automatic Means of Indicating the presence thereof in Buildings." By P. A. Blake, Esq.

"On Raising Sunken Ships." By T. Yates, Esq.

"On Construction of Iron War Ships and Fort Faces." By R. Bell, Esq., and

"On Improved Cooking and Heating Apparatus for Peat and other Fuel, with Suggestions for Food Reform." By Mrs. Amelia Lewis. A very interesting paper, which was fully illustrated by practical tests.

That the thanks of the Institute are due to the lady and gentlemen who read the above papers, the Council feel sure its members will readily agree. They have, it is true, already received votes of thanks at the meetings at which the papers were read; but the Council desire to propose a general vote of thanks from the Annual Meeting.

During the past year one of the oldest of the members of this Institute—we may fairly assume that he was the very oldest—has passed away from amongst us, and we need scarcely say that we allude to the death of Mr. Cornelius Varley, a man whose eminence in practical science was unquestionable, and whose geniality of character and moral worth were appreciated by all who had the happiness of his acquaintance. An account of his life is given in the Institute's Journal, of November, 1873. Death has also deprived us of Mr J. I. Russell, well-known in regard to the improved manufacture of tubes; and Mr De Bergue, also a well-known civil engineer and inventor.

Recently the attention of the Council has been called to the rules of the Institute which, being precisely the same as those adopted when the Institute was in its infancy, have in some particulars been considered susceptible of amendment. Taking this view of the matter, the Council some time ago appointed a Special Committee to consider and revise the rules and report thereon to the Council. This Committee has had several meetings; but, principally on account of Sir Antonio Brady, the Chairman of the Council, having had to proceed to America, has not yet reported on the subject. The Council, however, are prepared to suggest a course of action, and a new rule which they hope will be found to effect much of what is desired to be effected in regard to the rules.

The plan proposed is—that the Council do appoint an Executive Committee of 12 members, exclusive of the officers, and that this Committee shall be responsible for the management of the Institute; the Council retaining its power to dissolve this Committee and to deal with any matter as may be found requisite, should the necessity for such action on the part of the Council ever arise.

The new rule is:—1. That notwithstanding anything in the present rules contained as to the publication of minutes and giving of notices, it shall be deemed sufficient compliance therewith to publish such proceedings and notices as the Council or its Executive Committee may direct in the Journal of the Inventors' Institute, and all notices published in that Journal shall be deemed sufficient publication and notice, under the rules; unless when notices are specially ordered to be given by the Council or its Executive Committee. 2. That during the vacancy of the office of President of the Institute, the Chairman of the Council shall be deemed the President.

The Council also recommend the following practical arrangements to be made:—

The Chairman of the Council to be styled the President of the Council.

Two Vice-Presidents of the Council to be appointed, one, in absence of the President, to preside at Council meetings, the other at Executive Committees.

Also, for Treasurer, the Council recommend that M. M. Harris, Esq., be continued in that office, who kindly consents to act; and, as usual, Secretary and Auditors be elected.

The Council also recommends that Sir F. Cook, Sampson Lloyd, Esq., M.P., and Cromwell F. Varley, F.R.S., be elected as Vice-Presidents of the Institute.

Further, in order to facilitate the financial business, that the present Receiver of subscriptions be appointed Book-keeper by the Council.

The Secretary and Auditors to remain on the same footing as heretofore.

The audit of accounts of the Institute, which last year was very cursory, owing to the then recent death of the late lamented Secretary, R. M. Latham, Esq., in whom the Institute lost one of its founders, and an able and energetic promoter of its interests, has been very carefully conducted, and the Council are happy to say that, although the state of the finances show that they are susceptible of improvement, and, looking at the fact that some great movement ought now to be made on the Patent Law question, this is a matter every member ought to give serious attention to; yet the finances are in a very fair condition, as the balance-sheet now presented to the members will show, though, as above mentioned, the need of funds is very great to enable the Council to carry on in an energetic and spirited manner the various important operations, which are comprised in the programme of the Institute, and they hope that after this appeal no member will allow his subscription to remain in arrear.

The report of the Council having been read, and the balance sheet submitted to the meeting, on the motion of the CHAIRMAN, seconded by Mr. HILLIER, the report was received and adopted.

The Council was then elected, the list being the same as that stated in the advertisement of the Institute on another page.

Mr YATES then moved, and Mr. VARLEY seconded, the re-appointment of Mr. F. W. Campin as Secretary of the Institute, which was carried unanimously.

The re-appointment of Mr. C. G. Cartter, as Auditor, was then moved by Mr. A. J. MURRAY, and seconded by Mr. MORGAN, and carried unanimously. It was then proposed by Mr. CAMPIN, and seconded by Mr. MURRAY, and carried unanimously, that Mr. MARSHALL MASON HARRIS, Member of the Council, be Treasurer for the year ensuing.

The following votes of thanks were then carried unanimously:—

To Sir A. Brady, Chairman, Captain J. Selwyn, R.N., Vice-President, the other vice-presidents, and the rest of the Council of the past year, proposed by Mr. H. Hand, and seconded by Mr Hillier.

To the officers, proposed by Mr. Hillier, and seconded by Captain J. Selwyn, R.N.

Captain Selwyn responded for the Council (Sir A. Brady being absent in America), and Mr. Campin, the Secretary, for the officers.

To the readers of papers during the session, moved by Mr. Varley, seconded by Mr. Murray.

The proceedings terminated by a vote of thanks to the Chairman of the meeting, proposed by Captain Selwyn, and seconded by W. Yates, Esq., C.E.

INTERESTING ANCIENT RELIC.

At the meeting of the Royal Society of Literature, held on the 22nd April last (C. Clark, Esq., in the chair), an interesting paper was read "On the Silver Patera procured many Years Ago by Dr Lord in Badakhshan," contributed by Dr G. Birdwood. In this paper, Dr. Birdwood pointed out the singular interest attaching to this relic, of probably the fourth century A.D., and showed that it was, in character, late Roman work, of which, especially in size and preservation, few similar have come down to our time. The subject is the Triumph of Dionysus, who is represented reclining on a car, with the wine-bowl in his right hand, and drawn by two female figures. Behind him is a dancing Hercules, above two Eotes, and below a panther, pressing his head into the wine amphora. The material is of silver, and in some parts the patera has been heavily gilded. Dr. Birdwood thinks that the general debasement of the style of execution, and the feebleness and slovenliness of the treatment, clearly indicate that it belongs to an age when art was already severely suffering from the super-abundance of wealth and luxury, when it had fallen from the service of the gods, and had been prostituted to the ostentation of vulgar and upstart speculators. He further suggested that it might have been carried into Central Asia as a prize, either after the death of Julian, in A.D. 363, or at the sack of Antioch by the Persians, in A.D. 540.

DIVISION OF ALGEBRAIC QUANTITIES BY THE METHOD OF DETACHED CO-EFFICIENTS.

By Edward David Hearn, M.A., Columbia College, New York

The great economy of time and space, and the vast diminution of the chances of error secured by the use of Horner's method of detached co-efficients, whenever applicable, for performing the operation of division of algebraic quantities, has caused the method to be at all times regarded with great favour by practical men, although with the rule commonly given its application has been comparatively limited.

The student is usually taught that the method of detached co-efficients is not applicable to division unless the co-efficient of the leading term of the divisor be unity; but this is not really the case, although when the co-efficient of the leading term is not unity, the process must be somewhat modified. The reason is obvious, but as the modified process has never, so far as I know, been explained, I take the present opportunity of submitting it.

To economise space, I shall assume that the reader is acquainted with the processes of multiplication by the method of detached co-efficients, and with that of division by the same method when the co-efficient of the leading term is unity.

Now, we know that the figures which we obtain by multiplying the terms of the divisor (other than the first), by the several terms of the quotient as found give us, by the method in question, the true quotient; but only because the first line of the partial product, resulting from the multiplication of the quotient by the divisor, is identical with the quotient. But if the co efficient of the leading term of the divisor be not unity the first line of the partial product will be a multiple of the quotient, and mere addition or combination cannot assist us to discover what multiple of the true quotient it really is. But we can, by the use of simple arithmetical division, very readily correct the false quotient, term by term, and thus obtain the true co-efficient to work with for the purpose of discovering the next term. Suppose, for example, we desire to perform the division indicated by the formula—

$$\frac{21a^8+14a^7-49a^6-8a^5-10a^4+41a^3-a^2-14a+2}{3a^3+2a^2-7a+1}$$

We shall have no difficulty in doing so by the method of detached co-efficients, provided we be careful to correct by division the co-efficients of the quotient term by term as we come to them. The working of this example will be readily understood, and it will be seen that the economy of time is even greater than when the co efficient of the leading term of the divisor is unity.

```
 3 | 21 + 14 — 49 — 8 — 10 + 41 — 1 — 14 + 2
—2 |    — 14 + 0 + 0 + 10 + 0 — 4
+7 |         + 49 — 0 — 0 — 35 — 0 + 14
—1 |               — 7 — 0 + 0 + 5 + 0 — 2
   ————————————————————————————————————————
     —0   0   15   0   6
 7 — 0 — 0 — 5 — 0 + 2,   0   0   0
```

Here we have an example, which would otherwise have been somewhat tedious, manipulated with the same facility as though the co efficient of the leading term of the divisor were unity. We commence by dividing the first term of the dividend by the first term of the divisor, and place the quotient in the true quotient line. The products of this figure, when multiplied by $-2+7$ and -1 respectively, give us our first diagonal, and we place $-14+49$ and -7 in the second, third, and fourth columns. The sums of the second and third columns being zero, we have all ciphers for our second and third diagonals. The sum of the fourth column is -15, which we place in the "false quotient line," and, dividing it by 3 (the co efficient of the leading term of the divisor), we obtain -5 as the fourth term in the true quotient line. The products of this figure, when multiplied by $-2+7$ and -1, give us $+10-35$ and $+5$ for our fourth diagonal. The sum of the fifth column being zero, our fifth diagonal consists of ciphers. The sum of the sixth column is $+6$, which is placed in the false quotient line and divided by 3, which gives us $+2$ for the true quotient line. Using this $+2$ as multiplier, we obtain $-4+14$ and -2 for our sixth diagonal, and the sums of the seventh, eighth, and ninth columns being zero, shows us that there is no remainder.

It must be remembered that, in the remainder columns, the false quotient line is not used, and that the figures representing the co-efficients of the terms of the remainder are never used to produce diagonals—the same is the case when the co-efficient of the leading term of the divisor is unity.

Let us now value our quotient. We know that dividing $21a^8$, the first term of the dividend, by $3a^3$, the first term of the divisor, gives us $7a^5$ for the first term of the quotient, therefore, the complete quotient will be $7a^5-0a^4-0a^3-5a^2-0a+2$; or omitting the insignificant terms, $7a^5-5a^2+2$, which is the true quotient.

In order to show that the remainder comes out correctly as well as the quotient, we will perform, by the same method, the division indicated by the formula—

$$\frac{2a^5+7a^4+20a^3+30a^2+41a+30}{2a^3+3a^2+4a+7}$$

As the co-efficient of the leading term of the divisor is not unity, we again use our "false quotient line;" and the working will stand thus:—

```
 2 | 2 + 7 + 20 + 30 + 41 + 30
—3 |   — 3 — 6 — 15
—4 |       — 4 — 8 — 20
—7 |           — 7 — 14 — 35
   ——————————————————————————
     + 4 + 10,
   ——————————————————————————
   1 + 2 + 5, — 0 + 7 — 5
```

It will be unnecessary to give the details of the working, as it is similar to that already explained. By valuing the result obtained, as before, we have,

Quotient .... a^2+2a+5
Remainder ...... $7a-5$

It may be mentioned that when there are more quotient columns than remainder columns, the remainder is ranged from the right hand, as shown above. With further modification many more complicated divisions may be performed by the method of detached co-efficients; but these need not here be referred to.

Correspondence.

STOTT'S SYSTEM OF SEWER VENTILATION.

To the Editor of the Scientific and Literary Review.

Sir,—I beg respectfully to thank you for inserting in your paper of May 1st the favourable report on my system of ventilating sewers and drains of their noxious gases contained in your notice of the Manchester Exhibition, and, at the same time, beg to correct an error in the name. You have it in your paper Clott's, which is wrong, it should be "Stott's" System. I may say that the system has been in operation at Halifax and several other places two years, it has proved so successful in Halifax that the corporation have bought for that town the right to fix as many as they require. I am, &c.,

Henry Stott.

[We shall be glad to receive a more definite description of Mr. Stott's invention.—Ed. S. & L. R.]

AIR CUSHIONS.

To the Editor of the Scientific and Literary Review.

Sir, Might it not be practicable to apply the principle of the air cushion to canoes made of skins for travellers, so that the canoe could be inflated to cross a river or swollen stream? and could it possibly be made useful in the car of a balloon?

H.

Poison in Sweets.—Dr. Cameron, of Dublin, in his account of an analysis of sweets, gave the following description of a "baby in its cradle," apparently a delicious sweetmeat.—The cradle was made of plaister of Paris and sugar, and the body of the baby was of sugar and starch. Its eyes were Prussian blue, its cheeks stained with cochineal, and its clothes were painted with chromate of lead.

London Gregorian Choral Association.—Under this association, the President of which is the Right Hon. the Earl of Beauchamp, a festival service was holden at St. Paul's Cathedral on Thursday, 7th May. The choir consisted of 1,000 voices, accompanied with two trumpets, two euphoniums, and four trombones. The organists were Dr. Stainer and Warwick Jordan, Bac. Mus. Oxon. The music generally was superior to the former festival. Of the Psalms we think "Beatus vir qui timet" was the best performed. The introduction to the anthem was very telling. It seemed composed for the occasion; indeed, we cannot praise too highly the organ performance throughout. We wish good musical festivals were more frequent. Judging from the crowded congregation, they are much appreciated and becoming very popular.

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THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON

ESTABLISHED 1ST MAY, 1862.

Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES.—SESSION 1873-4.

Attendance of Members and their Friends is requested on—

THURSDAY, June 11th.—"On Anti-Wave Ships." By Dr CARMICHAEL.

THURSDAY, June 18th.—Council Meeting at half-past 7 p m.

TO MEMBERS OF COUNCIL.

Council Meetings at 7 p m. on 11th June.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F W. CAMPIN, Sec.

Proceedings of the Institute.

At the meeting of the Council (ordinary and special) held on 30th April, 1874, Mr. M. M. Harris presiding, the last minutes having been passed, it was agreed, in consequence of the members' meeting, to be held that evening, being of a special character, and Dr. Hardwicke who was to preside thereat having to be welcomed by the Council, to adjourn all other business till Thursday, 7th May.

At the adjourned meeting, on 7th May, M M. Harris, Esq., presiding, the Secretary presented a sketch of the proposed report of the Council to the Annual General Meeting. This having been considered, and various suggestions made thereon, it was left to the Secretary to complete the draft and bring it up at the next meeting of the Council, on 14th inst.

It was resolved unanimously that in said Annual Report the appointment of an Executive Committee of the Council of 12 members be recommended, and that notices given in the Journal of the Inventors' Institute (SCIENTIFIC AND LITERARY REVIEW) be sufficient notices, unless the Council or Executive Committee (when appointed) direct notices to be specially sent to each member.

The Secretary and Auditor announced that they intended to become life members; also Fredk. Harper, Esq

Mr. M. M. Harris, being willing to accept the treasurership, was nominated thereto. And it was recommended that the Receiver should be authorized to make the periodical payments to the Journal of the Institute, and present vouchers thereof to the Treasurer; and also, when ordered, the Secretary's salary. Balances to be paid to a deposit account at banker's.

It was proposed to have a public dinner, but thus it was ultimately determined to defer till the opening of the next session.

At the meeting of the Council (ordinary and special) held on 14th May, M. M. Harris, Esq., in the chair, the minutes of the last meeting were passed, and the draft of the report, as completed by the Secretary, agreed to, and ordered to be presented to the Annual Meeting (This report is given in another column.)

At the meeting on 30th April a very pleasant *réunion* of members took place, many ladies being present. Light refreshments were served in the Council Room. Mrs. Lewis's address and the discussion thereon are given in another column.

The Annual General Meeting is reported at another page.

Monthly Notices.

The Resignation of Professor Sharpey, of the Chair of Anatomy and Physiology at University College, which he has held for nearly forty years, is announced.

The Death of Mr. George Warington, Scholar and B.A. of Caius College, Cambridge, at Pieter Maritzburgh, at the age of thirty-three, is announced. He succeeded his father as Chemist to the Apothecaries' Company.

Mr. Leonard Lyell, the nephew of Sir C Lyell, Bart., has been appointed Professor of Natural Science in the University College of Wales.

Mr. Tower, C.E., known to the public as the inventor of "Tower's Speed Indicator," and as the assistant of Sir W. Thomson in his deep-sea soundings off Gibraltar, also as associated with Mr. W. Froude in his experiments on the rolling of vessels, which led to important results in our dockyards, has recently accepted the post of Constructor of Torpedoes in Sir W. Armstrong's works at Elswick.

An International Monument to Captain Maury, which shall take the form of a lighthouse, is proposed.

Lady Graduates.—A memorial has been presented to the Premier, signed by twenty-six of the Professors of the four Scotch Universities, praying that he would take into immediate consideration the difficulties at present in the way of ladies desiring to matriculate in Medicine at the Scotch Universities; and that Universities should by enactment be, if not *required*, at least *enabled* to make arrangements for the education of women. The Convocatoin of the University of London (the general body of members) have voted in favour of the admission of women as members; the matter, however, has yet to come before the Senate.

The Russian Scientific Expedition to Amu Daria is finally organised under the command of the Grand Duke Nicholas Constantinovitch, assisted by Col. Stoletoff and Dr. Moreff as secretary. Explorations will also be made beyond the confines of the Russian territory in the Khanate of Bokhara, up the course of the Amu Daria—if political matters in Central Asia will permit. The commander and most of the members of the expedition were to have left St Petersburg on Sunday, the 26th of April.

Colouring Matter from Sawdust.—Messrs. Croissant and Bretonniere, says the *Athenæum*, have patented a process for obtaining valuable colouring matters from saw-dust, bran, and various waste substances. When such materials are heated with caustic soda and flowers of sulphur, a sulphide of sodium is produced, and this, re acting on the organic matter, effects its dehydrogenation, with evolution of sulphuretted hydrogen. The result is said to be a valuable dye-stuff, having strong affinity for organic fibres By varying the proportions of the materials used, a variety of tints may be obtained from one and the same substance.

Crystallized Glass, obtained from bottle-glass works at Blanzy, in France, has been the subject of investigation by Mr. Peligot. These specimens differ from ordinary devitrified glass in being well crystallized in prismatic forms resembling augite. The analysis of this glass tends to support the views of some chemists that devitrified glass is not simply distinguished from vitrified glass in arrangement of molecules, but differs in chemical composition from vitreous, the crystallised parts containing more magnesia and less soda than the clear glass from which the crystals had separated.

Crystal Palace Flower Show.—The annual grand flower show of the season took place on Saturday, 9th ult, which upon the whole was superior to former years. The flowers were very beautifully arranged on each side, from end to end, while the bright colours harmonised admirably with the many gaily-dressed ladies who thronged the promenade The display of roses, azaleas, calceolarias, and ericas met with universal praise. The profusion of bloom which some of these exhibited surpass the rival shows of the Horticultural Gardens The pansies, placed on elegant stands, were greatly admired; the light and shade in these flowers were the perfection of beauty. We noticed that some few of the petals and corolla of the ericas were not perfect, but this probably arose in transit. Our space will not permit us to notice the prizes, of which there were many. Great praise is due to the secretary for the admirable manner in which these shows are arranged.

Proceedings of Societies.

ROYAL SOCIETY.

APRIL 16TH.—The President in the chair.—The following papers were read.—"On the Pneumatic Action which accompanies the Articulation of Sounds by the Human Voice, as exhibited by a Recording Instrument," by Mr. W. H. Barlow; "Note on the Periodicity of Rainfall," by Mr. J. H. N. Hennessey; and "Studies on Biogenesis," by Dr. W. Roberts.

April 23rd.—The President in the chair.—The following papers were read:—"On some Points connected with the Circulation of the Blood, arrived at from a Study of the Sphygmograph Trace," by Mr. A. H. Garrod; "Note on the Minute Anatomy of the Alimentary Canal," by Mr. H. Watney, and "On the Refraction of Sound by the Atmosphere," by Prof O. Reynolds.

April 30th.—Professor A. C. Ramsay, V.P., in the chair. The following papers were read.—"The Structure of the Mucous Membrane of the Uterus and its Periodical Changes," by Dr. J. Williams, "On Leaf-Arrangement," by Dr. H. Airy; and "On the Improvement of the Spectroscope," by Mr. T. Grubb.

ROYAL INSTITUTION.

MAY 1ST.—Annual Meeting.—Warren De La Rue, Esq., V.P., in the chair. The Annual Report of the Committee of Visitors for the year 1873 was read and adopted. This Report testifies to the increasing prosperity and efficiency of the Institution, and congratulates the Members on the fact that the new laboratories have been constructed and fitted up by means of funds contributed by themselves; and that this heavy charge in not larger than what the surplus income of a few years will probably be able to reimburse. Fifty new members were elected in 1873. Sixty-two lectures and nineteen evening discourses were delivered. The books and pamphlets presented amounted to about 120 volumes, making, with those purchased by the Managers, a total of 239 volumes added to the library in the year, exclusive of periodicals. Thanks were voted to the President, Treasurer, and Secretary, to the Committees of Managers and Visitors and to the Professors, for their services to the Institution during the past year. The following gentlemen were elected as officers for the ensuing year:—President, the Duke of Northumberland; Treasurer, G. Busk; Secretary, W. Spottiswoode; Managers, G. Berkley, Admiral Sir H. J. Codrington, Warren De La Rue, Sir T. F. Elliott, E. Frankland, F. Galton, J. P. Gassiot, C. H. Hawkins, A. Latham, J. C. Moore, Sir W. F. Pollock, the Earl of Rosse, R. P. Roupell, C. W. Siemens, and Colonel P. J. Yorke; Visitors, J. Brown, J. C. Burgoyne, A. J. Ellis, Colonel J. A. Grant, Lieut.-Gen. Sir F. W. Hamilton, T. H. Hills, R. P. Linton, W. Millar, A. C. B. Neill, W. S. Portal, W. Salmon, J. B. Sedgwick, J. Spedding, the Hon. J. G. P. Vereker, and H. Wedgwood.

May 4th.—The Duke of Northumberland, President, in the chair. Miss C. C. Astley, Messrs. G. L. Bassett, W. M. Brown, J. O. Corrie, H. Deacon, G. K. Hardie, G. J. S. Lock, T. F. Miller, S. Sampson, and T. Taylor were elected Members. J. Tyndall, Esq., was re-elected Professor of Natural Philosophy. The Managers announced that they had appointed J. H. Gladstone, Esq., Fullerian Professor of Chemistry.

ROYAL SOCIETY OF LITERATURE.

APRIL 29TH.—The following were the Council and Officers elected for the ensuing year:—President, The Lord Bishop of St. David's; Vice-Presidents, The Lord Archbishop of Canterbury, the Duke of Devonshire, the Dean of Westminster, Right Hon. Sir W. Erle, Sir H. C. Rawlinson, H. Fox Talbot, Esq., Sir P. de Colquhoun, Sir C. Nicholson, Bart., Major-Gen. Sir C. Dickson, and the Rev. C. Babington; Council, Messrs. W. de Gray Birch, J. W. Bone, E. W. Brabrook, C. H. E. Carmichael, C. Clark (Treasurer), C. Goolden, S. G. Grady, N. E. S. A. Hamilton (Hon. Librarian), C. Harrison, J. Haynes, R. B. Holt, C. M. Ingleby (Foreign Secretary), G. W. Moon, C. R. des Ruffières, W. S. W. Vaux (Secretary), and H. W. Willoughby; Auditors, Rev. T. Hugo and H. Jeula; Clerk, Mr. Ayres; Collector, Mr. G. A. Stretton.

THE INSTITUTION OF CIVIL ENGINEERS.

AT the meeting of this society on Tuesday, May 5, 1874, Mr. Harrison, president in the chair, twenty-three gentlemen were balloted for and declared to be duly elected, of whom five were members, viz. Messrs Percy Burrell, joint consulting engineer to the Government of Paraguay; Thomas Curtis Clarke, Philadelphia, U.S.A.; Charles William Hawkins, locomotive superintendent of the Great Indian Peninsula Railway; William King, engineer to the Liverpool United Gas Light Company; and Henry Valpot Francis Valpy, joint consulting engineer to the Government of Paraguay. Eighteen gentlemen were elected associates, viz.: Messrs. Thomas Hope Green Berrey, superintendent and manager of the Manchester Water Supply; George Woulfe Brenan, Bishopsgate-street; John Richard Brittle, Westminster; William Frederic Butler, Westminster; Frank Cheesman, Stud Inst. C.E., chief engineer to the Japan Paper Making Company, Henry Deane, B.A., sub-manager of the ship-yard of the Danube Steam Navigation Company, Charles Preston Gibbons, Stud. Inst. C.E., contractors' staff, West Surrey Waterworks; Edward Worrell Jarvis, resident engineer, Canadian Pacific Railway; Thomas William Jeffcock, Sheffield; William Millbanke Mayes, Bilbao, Spain, John Charles Melliss, Kenilworth; Edward Perrett, Westminster; Joaquim Galdino Pimentel, Rio de Janeiro; Robert Sharland, Stud Inst. C.E., resident engineer of the Aba-el-Wakf Sugar Factory, Egypt; Walter Halsted Cortis Stanford, Westminster; Edward Herbert Stone, Stud. Inst. C.E., assistant to superintending engineer, Nizam's State Railway; Archibald Sutter, Edinburgh; and Henry Michell Whitley, Westminster.

It was announced that the Council, acting under the provisions of the bye laws, had transferred Messrs. Wilfrid Airy, B.A., Henry John Card Anderson, Marcus Smith, and Wilberforce Wilson, from the class of associate to that of member; and had admitted the following candidates as students of the institution—viz.. Messrs. Lawford Maclean Acland, Percy Leonard Addison, Robert Philip Atkinson, Charles John Seymour Baker, Edward Baker, Alfred William Thomas Bean, Alexander Bewley, Hugh Robert Blackburn, Percy Wilson Britton, William Henry Cole, George Owen William Dunn, Charles Henry Holme, Edward Henry Johns, Lawrence Moore Kortwright, Francklyn Lang, William Cuthbert Lewis, Edward Loycester, Charles Perrin, and the Hon. Lockhart Matthew St. Clair.

ZOOLOGICAL SOCIETY.

APRIL 21ST.—The Viscount Walden, President in the chair. The Secretary read a report on the additions that had been made to the Society's Menagerie during 1874. Among these particular attention was called to a scarce parrot (*Chrysotis Finschi*), of which a specimen had been presented by Mrs. Chivers. Letters and communications were read:—From Mr. M. Allport, on the capture of a grilse in the River Derwent, in Tasmania; from Dr. J. E. Gray, "On the very Young of the Jaguar, *Felis (leopardus) onca*," "On the Short-Tailed Armadillo, *Muletia septemcincta*," "On the Young of Bosch Vark, *Potamochoerus Africanus*, from Madagascar," and "On the Skulls of the Leopard in the British Museum;" from Dr. O. Finsch, on a new species of penguin, from New Zealand, which he proposed to call *Eudyptula albosignata*; from Capt. W. H. Unwin, on the breeding of the Golden Eagle (*Aquila chrysaetos*) in North-Western India; by Mr. J. E. Harting, on a new species of Tringa, from St. Paul's Island, Alaska, which he proposed to name *Tringa gracilis*; from Lieut. R. W. Ramsay, on an apparently new species of woodpecker, which he had obtained in a teak-forest, about six miles to the north of Tanghoo, in British Burmah, which he proposed to name *Gecinus erythropygius*; by Messrs. W. T. Blanford and H. E. Dresser, on the genus Saxicola, Bechstein, being an attempt to reduce into some order the excessively confused nomenclature of the species composing this genus. Mr. E Ward exhibited the skull and horns of a fine specimen of the Persian stag (*Cervus maral*), from the Crimea.

May 5th, 1873.—Dr. E. Hamilton, Vice-President, in the chair.—The Secretary read a report on the additions that had been made to the society's menagerie during the month of April, 1874, amongst which were a Vigne's sheep (*Ovis vignii*), presented by Captain Archibald; a white-cheeked flying squirrel (*Pteromys leucogenys*), presented by Mr. A. Gower; a new kangaroo (*Halmaturus luctuosus*), deposited by Sig. L. M. d'Albertis, and four bladder-nosed seals, presented by Captain D. Gray and Captain Alexander Gray. Mr Sclater made some remarks on the cassowary, living in the society's gardens, hitherto called Kaup's cassowary, which, it appeared, ought to bear the name *Casuarius papuensis*. Mr. Sclater announced that H. M. Government had consented to send a naturalist to Kerguelen's Land to accompany the Astronomical Expedition shortly proceeding there, and that the Rev. A. E. Eaton had been selected by the Royal Society for the post. Mr. Blanford exhibited and made remarks on a series of the ibex of Persia, which he considered to be referable to *Capra aegagrus* Mr. A. H Garrod, F Z.S, read a paper on the anatomy of the columbæ, in which a new arrangement of that group of birds was proposed, based upon certain points not hitherto sufficiently investigated A communication was read from Dr. Julius Haast, containing the description of a new species of *Euphysetes* (*Euphysetes pottsi*), a remarkably small catodont whale, which had occurred on the coast of New Zealand. A communication was read from Mr. Frederick Moore, containing a list of Diurnal Lepidoptera collected in Cashmere by Captain R. B. Reed, 12th Regiment, with descriptions of new species. A communication was read from Mr. A. G. Butler, containing a complete list of the known Diurnal Lepidoptera of the South Sea Islands. Mr. Howard Saunders read a paper on the grey-capped gulls, in which several species hitherto confounded were distinguished. A paper was read by Dr. A. Günther, F.R.S., entitled, "A Contribution to the Fauna of Savage Island," in which several new lizards peculiar to this remote Pacific Island were described, and other animals found in it were mentioned. A communication was read from Dr. J. S. Bowerbank, F.R.S, containing the sixth part of his "Contributions to a General History of the Spongiadæ." Mr. R. B. Sharpe read a paper on a small collection of birds made in Bulama, one of the Bissagos Islands, West Africa, by Lieut. Bulger.

CHEMICAL SOCIETY.

APRIL 16TH.—Prof. Odling in the chair.—Dr. A. W. Tilden read a paper "On Aqua Regia and the Nitrosyl Chlorides." He finds that when the gases evolved on gently heating aqua regia are passed into concentrated sulphuric acid, a product is obtained which, at a low temperature, deposits crystals of nitrosyl sulphate, $NOHSO_4$. Both these crystals and the liquid, when mixed with sodium chloride, and gently heated, evolve nitrosyl chloride, NOCl, an orange yellow

gas, which may be condensed to a deep orange red liquid, boiling at 8° Cent. The author could not obtain the dichloride NOCl$_2$, which Gay-Lussac supposed to exist, but which he believes to be merely a solution of chlorine in the monochloride. Dr. C. R. A. Wright read a paper "On Isomeric Terpenes and their Derivatives, Part IV., Section 1, On Cajeput Oil," by C. R. A. Wright and Mr. T. Lambert. It was found that the cajeputol $C_{10}H_{18}O$, boiling at 176°—179° Cent., obtained from oil of cajeput, combines with bromine, forming the compound $C_{10}H_{18}Br_2O$. On heating this, it splits up into cymene, $C_{10}H_{14}$, hydrobromic acid and water. Section 2, "Action of Pentasulphide of Phosphorus on Terpenes and their Derivatives," by Dr. C. R. A. Wright. When cajeputol is treated with the pentasulphide, it yields a mixture of terpene and cymene, the latter being formed by a secondary action of the pentasulphide or the terpene. This was shown to be the case by treating the terpene from oil of turpentine and hesperidene with the penta sulphide, when cymene was formed in both cases.

GEOLOGICAL SOCIETY.

APRIL 15TH.—J. Evans, Esq., President, in the chair. Mr. H. M. Whitehead was elected a fellow. The following communications were read:—"About Polar Glaciation," by Mr. J. F. Campbell; and "Note regarding the Occurrence of Jade in the Karakash Valley, on the Southern Borders of Turkestan," by Dr. F. Stolicska.

SOCIETY OF ANTIQUARIES.

APRIL 23RD.—Anniversary Meeting.—The following were elected council and officers for the ensuing year —Eleven members of the old council were re-chosen of the new council, as follows: The Right Hon. the Earl Stanhope, President; J. Winter Jones, Vice President, C. S. Perceval, Treasurer, A. W. Franks, Director; J. Evans and G. L. Gower, Auditors, F. Ouvry, H. Reeve, and W. M. Wylie. Ten of the other Fellows were chosen of the new council, namely, E. Freshfield, Auditor; C. D. E. Fortnum, Rev. C. O. Goodford, P. C. Hardwick, Baron Heath, T. Lewin, H. S. Milman, Lord Redesdale, W. Smith, Sir H. M. Vavasour, Bart. C. K. Watson was re-elected Secretary. The President delivered an address, containing the usual obituary notices of Fellows deceased during the past year. Resolutions were passed expressive of the great regret felt by the Society at the retirement of Mr. Ouvry from the office of Treasurer, and at the death of their late Fellow and some time Director, Mr. Albert Way, who, in his last illness, had expressed a wish that 150 volumes from his library should be given to the society. To this wish the Honourable Mrs. Way had, in the most cordial manner, given effect

ANTHROPOLOGICAL INSTITUTE.

APRIL 14TH.—Prof. Busk, President, in the chair. Mr. W. Stoate was elected a Member. Mr. J Brent exhibited and described a series of flint implements from Canterbury and Reculver. A description, by Mr. Howorth, was read on an Ashanti fetish letter or curse. The document, which was lent by Capt. Gordon for exhibition, was written in the Arabic character, and in the language of the Barbu tribe, on a sheet of rough paper of large foolscap size, folded about two inches square, and tied with green thread The letter contained a prayer that the English might fight among themselves and return to the coast, and that pestilence might overtake them. The Ashanti grievances were enumerated, and it stated that the white man came with covetous eyes and seized the land, and that covetousness brought down the curses of Suleiman, the high priest. It was thought by the English officials that it was Suleiman himself who endeavoured to stay the British troops on their approach by throwing down the fetish, and that his failure would probably cost him his life. Capt. S. P. Oliver contributed a series of papers "On the Non-historic Stone Relics of the Mediterranean." The series comprised full accounts, with ample illustrations, of the Torre dei Giganti, Malta, Tumuli near Smyrna, Dolmen-Mounds of the Albegna, Sardinian Nuragghia, and the Sepolture de is Gigantes of Sardinia.

March 28th.—Prof. Busk, President, in the chair.—Mr. C. C. Tennant was elected as a Member. Mr. H. H. Howorth read a paper, "Strictures on Darwinism, Part III., on Gradual Variation." The paper was in continuation of a series in which the author endeavoured to show that Mr. Darwin's main conclusion is not supported by the evidence of the changes in type that can be examined. Mr. Darwin differed from the older naturalists in assigning as the cause of variation a struggle between the individuals of a class for existence, by which a favoured individual and its progeny eventually survive. They, on the contrary, argued that variation is induced by a change in the external conditions of climate, food, &c., which operate upon the whole class together, and make it change, as a whole, in a certain definite manner and direction,—that is, in one which can be actually predicted, so that if any individual of a class, or any number of individuals of a class, be subjected to a certain alteration of conditions, a certain definite and uniform change will be produced in the individual or the class. Again, if the new conditions were annihilated, the object of the experiment is reverted to its original surroundings. The author supported that argument by a large number of facts, and, in doing so, was constrained to conclude that the operating cause of variation in man, as in the case of plants and animals, is the working of external causes; and that an individual with its progeny is not so much better fitted for enduring the new conditions that it eventually supplants the rest, but rather that the whole class is moulded together into a new shape, which is called a new variety. Some facts were drawn from the experience of history, showing that where the conditions have been uniform, as in Egypt, although there has been a considerable mutual pressure among the individuals of a class for food, &c., yet there has been no variation; while a transplanting of similar individuals, as in the case of European emigration to America, has been followed by almost immediate change. The illustrations that might be drawn from the cases of man, as in the changes that have ensued in both the Aryan and the Black Emigrants to North America, in the Dutch at the Cape, in the Portuguese at South America, &c., were notable and telling instances of the operation of the law argued for by the author, inasmuch as changes of type of a marked character have occurred where there has been neither time nor opportunity for the creation of a fresh type by the successive amelioration or change in the idiosyncrasies of the descendants of a common ancestor, but where the change has undoubtedly occurred in the whole class together over a very wide area.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

MAY 5TH —Dr. Birch, President, in the chair. The following candidates were elected Members:—Miss E. Bagster, Messrs. H. Bland, W. Boscawen, jun., J. Dryden, J. H. Lydall, Rev. J. M. Fuller, and Rev. Canon Lance. The following papers were read:—"Synchronous History of Assyria and Judah, B.C. 745-688," by Mr. J. W. Bosanquet, Treasurer. "Revised Translation of the Descent of Ishtar, with a further Commentary," by Mr. H. Fox Talbot. In this paper the learned Assyriologist showed that the Legend of the Descent of Ishtar was, in its present form, dramatically arranged as a species of Mystery or Miracle Play. The translator was not able to render the whole text more complete by the addition of a fragment of a duplicate copy, containing ten lines, recently found by Mr. G. Smith in the British Museum. "On the Egyptian Altar at Turin," drawn by Mr. J. Bonomi, and described by Mr. S. Sharpe. "Translation of the Hieroglyphic Inscription upon the Granite Altar at Turin," by Dr. S. Birch, President.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

APRIL 22ND.—Council Meeting.—G. R. Wright, Esq., in the chair. The list of the Officers and Council for the ensuing year, to be submitted to the Annual General Meeting in May, was read and approved, and an announcement made from the chair that K. D. Hodgson, Esq., M.P., would preside at the Annual Congress to be holden at Bristol, from the 4th to the 10th August next, succeeding to the Duke of Norfolk as President of the Association. It was also announced that the services of Mr. J. Reynolds had been retained as Honorary Local Secretary for the forthcoming Congress.—Evening Meeting.—The Rev. S. Mayhew, M.A., in the chair. An exhibition of Early English and Later Dutch Pottery, with some specimens of Venetian Glass, was made by Messrs. E. Roberts, Bailey, and Mayhew; and afterwards a paper was read by Mr. H. Syer-Cuming, on the origin of and causes which led to the Nine of Diamonds being called the Curse of Scotland. This subject of inquiry produced a discussion, in which the Chairman, Messrs. S. J. Tucker, Rouge, Croix, R. N. Philips, D.C.L., E. Roberts, and Wright, took part. A paper was read, "On the Discovery of an Ancient British Interment, near Beddington Park, Surrey," by Mr. E. P. L. Brock.

METEOROLOGICAL SOCIETY.

APRIL 15TH.—Dr. R. J. Mann, President, in the chair. Rev. C. Gape, Dr. R. Lord, Messrs. T. W. Baker, F. Green, F J. Sparks, and G. M. Whipple, were elected Fellows. The following papers were read:—"On the Climate of Patras, Greece," by the Rev. H. A. Boys The author shows that the climate of Patras is naturally mild and relaxing, seldom disagreeably dry, and not often very damp, being, indeed, drier by a good deal than any part of England. "Remarks on the Atlantic Hurricane of August 20th to 24th, 1873," by Mr. W. R. Birt. "On the Meteorology of December in the Southernmost Part of the South Indian Ocean," by Mr. R. H. Scott. This paper had been prepared expressly to give information on the climate of Kerguelen Island to those gentlemen who are going out to observe the Transit of Venus in December next. "On the Diurnal Variations of the Barometer," by Mr J. K Laughton. Whilst it has long been well known that barometric maxima and minima recur daily with unfailing regularity, especially within the tropics, the cause of this recurrence is yet unknown; and though it has been attributed to the different temperatures and humidity at different times of the day, such explanation is far from satisfactory, for the maxima occur at the times of mean temperature and humidity, without regard to the direction of the change; and the minima occur indifferently at the times of both greatest and least temperature and humidity. It seems that an explanation is rather to be found in the inertia of the atmosphere, which, in the first instance, permits the air to have its elastic force increased by a rapidly increasing temperature before the inertia of rest can be overcome sufficiently to allow it to enlarge its volume in due proportion; but that when that inertia of rest is overcome, then the inertia of motion permits it to move away from the place of observation in excess of what is due to the increased elasticity, the nocturnal maximum and minimum being caused by the radiant power of the air,

which gives it alternately an inward and outward motion, and each way, in excess of what is due to the decrease or increase of elasticity, by reason of the inertia of motion. If this explanation is correct, we ought to find a certain tendency of the wind towards east in the morning and towards west in the evening, and this tendency does seem to be shown in the very few published observations which permit a comparison to be made. Further observations, as confirming or disproving the proposed theory, are much to be desired.

LINNEAN SOCIETY.

APRIL 16TH. — H. Tronen, Esq., in the chair. Mr. G. E. Dobson was elected a fellow. Dr. Masters, Mr. G. Maw, and Mr. Hern were chosen to represent the Society at the International Horticultural and Botanical Congress, to be held at Florence in May. — Prof. Oliver exhibited a remarkable fruit of Duboscia, obtained from Coomassie. Mr. A. Murray exhibited some interesting specimens of silicified wood, from North-west America. Mr. J. G. Baker exhibited a Cheilanthes, from New Granada, identical with *C. Dalhousiae*, from the Himalayas. Prof. Thiselton-Dyer exhibited some striking fruits of Dipterocarpus. The following papers were read: "Contributions to the Botany of H.M.S. Challenger Expedition, Nos. III. XIV."

MRS. LEWIS'S COOKING APPARATUS FOR FOOD REFORM.

The address, in lieu of a paper, delivered by Mrs. Amelia Lewis, with the discussion thereon, at the meeting of the Inventors' Institute on 30th April, 1874, are, in substance, as follows:—

After some general observations on the importance of the art of cooking, and of the application of scientific principles to the system of, and apparatus and appliances for, carrying on the operation of cookery, Mrs. LEWIS stated that the main object she had in view was the practical improvement of the preparation of the food of the humbler classes of society. Her stove and its appliances which she had devised with the assistance of a very clever mechanical man, were on the principle of the ancient brazier, her description of brazier being a simple mechanical contrivance made to turn so as to regulate the draft, and consequently the expenditure of fuel. A strong fire could be obtained by this means, or the coal or peat which is used — for it will burn either — can be reduced almost to a spark, a great desideratum, not only in warm weather for the well-to-do, but one which will, no doubt, be highly prized by the poor on account of the saving thereby attained. For cheapness and cleanliness, however, she much preferred peat fuel. By using that particular sort of stove the room was warmed equally in all parts, a most essential thing to health, and persons were not frozen upon one side and scorched upon the other. (Cheers and laughter.) Another among many advantages which it possessed was that it emitted no smoke. One of the greatest elements in preserving good health was to have an equal temperature in our houses. Whether in the cottage or the mansion, it was of the utmost importance to preserve the apartments at one heating point, and to attain that they must look to science, for science had been very beneficent, but art had been truly selfish; science worked on large general rules and certain principles; art, however, upon the other hand, mostly went back to the individual. With respect to cooking and heating our homes, science had done but little as yet in this country, but she was glad to be able to say that there was a grand awakening with respect to these all important matters. (Cheers.) She had devoted herself to the proper manner of preparing food, and it was a question, she thought, which was one of the grandest that could occupy any woman's attention. (Cheers.) If we had a better system of cooking, we should find pauperism lessened, lunacy lessened, vice and crime lessened, drunkenness almost made impossible, and our hospitals not half so full as they were at present. (Cheers.) She did not object to hospitals, for why should she, as they did so much good? but she was of opinion if some of the money which was obtained on Hospital Sunday could be devoted to giving the people the means of obtaining good and wholesome food it could do an enormous amount of good. (Cheers.) It should be borne in mind that the human machine would only go according to the quality and substance of the food which was put into it. If we had not oxygen and hydrogen, and nitrogen and phosphorus, and other matters supplied to the system in properly cooked food, we could not possibly preserve our bodies or our minds in a healthy state. It might be said the people could not obtain all this, which however, was nonsense. She believed in poor people, but she did not believe in badly-fed people or starving people in a land of plenty. The fact was, that infinitely too much was expended at the present time in food, and the manner in which it was prepared was wasteful in the extreme. People now put their vegetables, their meats, and their fish into water and boiled or stewed them until most of the nutritive portions of them had been absorbed in that element. The same thing might be said with regard to roasting and baking. These processes were equally deleterious, for they only hardened the meat and destroyed its juices. The only mode of cooking properly so as to obtain every particle of nourishment the various edibles contained was either by steaming or allowing the live flame in a covered pan to get near them. Mrs. Lewis here gave one of her recipes for cooking fresh herrings, which she assured those present would be found to add much to the natural fine flavour of the fish, and prevent it causing indigestion. The plan she recommended was to steam it in vinegar and water, when it would be found that an infant or sick person might eat it without any ill effects. (Hear, hear.) If the women knew only how to cook properly they would not have their husbands grumbling, as they now sometimes did, for they would not be suffering from indigestion, neither would they have their children beaten or upbraided by the schoolmaster for what was considered inattention, when in reality the poor little things were suffering from badly cooked food. (Hear, hear, and cheers.) What was required in order to bring about a better state of things was for the School Board to take the question up theoretically, and some other body practically. There was no good trying to cook properly without theory, for it might just as well be said that a scientific man could get on without theory. (Hear, hear.) Food and condiments from abroad she strongly set her face against, especially for ladies, as their use produced in many instances the number of pale faces they exhibited. Soup, too, taken before dinner was a barbarism that no enlightened person should be guilty of. In conclusion, she said she had not so much to do with the higher classes as with the poor, although she had much to say to them. What she wanted to see was the working man's home made what it ought to be, comfortable, and she could assure all present that once such a stove as the one she had used that evening was introduced into a man's home it became quite a different dwelling. (Cheers.)

Practical public testing of her system is the plan on which Mrs. Lewis likes to proceed, and hence she had fitted up in the Institute's rooms two of her stoves, which, during the progress of her address, were kept in operation; and the rapidity of heat raising, getting up steam, and cooking effect were very remarkable. In a very few minutes the kettle was "singing," and, after a few more had passed, the pot, or rather cylinder, was boiling. This cylinder was about two feet high and something like a foot in diameter, and the interior was fitted with shelves, the object being to support a description of tin cullender, and these in turn hold the various vegetables. Three of these apparatuses were placed over the others in the steamer, the first containing a cauliflower, the next some potatoes, and the third turnips. Then, again, in a second pan were placed some fish, all of which turned out admirably, under the superintendence of the distinguished *chef*. The cauliflower was beautifully white, and the potatoes were like "balls of flour," but the most delicious of all were the turnips. These latter, by the mode in which they were treated, were neither watery nor spongy, but firm; and, what is more important, retained all their saccharine matter. Sausages, too, were also prepared, and gave entire satisfaction to everyone who partook of them. It may be a fact worthy of note that the whole cost of keeping a coal fire going in one of these patent stoves from seven in the morning until eleven at night costs but 2½d. This fact alone ought to be sufficient, even if there were no other advantages to be obtained by them, to ensure their success.

The CHAIRMAN (Dr. Hardwicke) said he felt great pleasure in again coming amongst the members of the Inventors' Institute, for he considered that by doing so he was cooperating with those who were working in a practical way for the advancement of the true civilized life. As a sanitarian, he necessarily took a deep interest in the preparation of food, and he considered it very hopeful for the cause of health and life to find a lady of education and talent like Mrs. Lewis coming forward to promote improvement in the art of cookery, and essaying to gave to it a foremost place in what in modern speech are termed technical sciences. Though he thought very highly of Mrs. Lewis's system and apparatus, and he fancied the audience held the same opinion, still, like every other invention, practical use and repeated trials were necessary to enable any one to pronounce a conclusive opinion, and some persons would require trials to be made, not in a well-ventilated room like that in which they were assembled, but in the close rooms and small cottages inhabited by the humbler classes, though, for that matter, if Mrs. Lewis's invention led people to let into their dwellings more fresh air, he should be highly pleased, and should consider it a great recommendation of the system. As he knew they were all there rather to take part in a practical investigation of this matter than to hear speeches, he would not detain them by any further remarks of his own.

Mr. VARLEY remarked that no subject demanded greater consideration at the present time than the economy of food, fuel and food both being very dear. The action of heat on raw substances was well worthy of scientific investigation, and he considered they were specially fortunate in having one so able to aid in this investigation, and capable of giving the subject a pleasant turn as Mrs. Lewis, and he would take leave to ask those present to vote her their thanks for her admirable address and demonstration that evening.

Mr. A. J. MURRAY seconded this, but would call upon some of those present to state their views on the subject.

Mr. YATES said that having for years resided in Germany, he fully recognised the waste that goes on in the ordinary English cooking system, and as an engineer and mechanician, he must say that Mrs. Lewis's invention was of a most promising character. He sincerely hoped she would meet with the success she so well deserved.

Mr. MOTTERSHEAD remarked that if Mrs. Lewis's invention depended upon peat, he feared it would be a difficulty in the way of

the success of the invention, for peat was a fuel obtainable only in a few parts of the country.

Mr. WILSON thought there were some points which ought to be considered before a decisive opinion could be given. Was steaming better than baking or roasting? Still Mrs. Lewis's apparatus was certainly a great addition to our cooking arrangements.

The vote was unanimously passed amidst much cheering.

Mrs. LEWIS responded, and then

Mr. CAMPIN (the Secretary) proposed a vote of thanks to Dr. Hardwicke, who had kindly taken the chair at that meeting. They all knew his important and pressing avocations left him but little time to spare, and they must have felt how much this important subject had been assisted by Dr. Hardwicke's presence in the chair. No one could have done more to bring out the points of advantage and utility embraced by Mrs. Lewis's valuable contribution to the important subject of cooking reform.

This was seconded by Mr. CARTTAR, and having been passed unanimously and acknowledged, the meeting ended.

APPLICATIONS FOR LETTERS PATENT.

(Continued from page 78.)

employed therein (com).—W. R. Lake. Air-tight joints for gas retorts (com.) (Complete specification).—G. T. Bousfield. Rock drilling machines (com.)—G. and H. Agar. Wind and rain impervious door plinth.—H. Benjamin. Extraction of oleaginous matters from wool washing suds or other liquids containing soapy matters or grease and the production of tallow or oil from the resulting substances.—H. A. Bonneville. Apparatus for the manufacture and application of wire coverings for securing the corks of bottles containing sparkling wines or other fermented or effervescent liquids (com.) (Complete specification).—D. Hipkins. Method of manufacturing artificial butter and of clarifying or purifying rancid butter.—W. C. Wingfield.—Portable court for playing the ancient game of tennis.—J. H. Betteley. Stopping and starting tramway cars.—S. H. Johnson, F.C.S. Construction of furnaces and retorts for the manufacture of bisulphide of carbon.—G. W. Baker. Sewing machines.

On February 24th.—689 to 702.—C. Heaton. Emery and other grinding machinery, and emery or other grinding wheels for use therewith.—T. Turton and E. Latham. Apparatus for transhipping coal and bulk cargo.—T. Bright. Method of extracting gold from auriferous antimony ores, antimonial compounds, and antimonial mixtures (com.)—H. W. Cracknell. Sash fastener.—I. Brown. Construction and arrangement of pipes for watering streets or roads, and for the purpose of irrigation.—J. T. Hopkins. Window-sash fastenings.—J. Keighley. Pickers used in weaving, and apparatus therefor.—S. Emsley. Apparatus for spinning and twisting wool, cotton, silk, and other fibrous substances.—J. F. Braidwood. Apparatus for securing lids or covers of gas and other retorts.—I. M. Singer. Sewing machines.—E. Pilkington. Apparatus for locking "safety lamps" used by miners.—E. Hunt. Bottles and stoppers for aërated liquids (com.)—W. R. Lake. Manufacture of substances to be used as floor coverings, and for similar purposes, from paper-pulp, sponge, and other like materials (com.) (Complete specification.)—J. H. Weston. Purifying, carburetting, and increasing the illuminating power of coal gas.

On February 25th.—703 to 721.—R. J. Hennay. Water alarm. (Complete specification.)—E. Hulme, J. Hulme, and W. Hulme. Appliances for controlling the admission of steam and other elastic fluids to motive-power engines.—J. Davey. Ploughs, the improvements being applicable to single-furrow, double-furrow, and triple-furrow turn-wrest ploughs.—O. A. Tenlon. Rotary engines for operating propellers and other shafts where counter-thrust is required.—A. Jackson, G. Jackson, and J. Smith. Looms for weaving, and apparatus connected therewith.—E. Coules. Button-hole stitching attachments for sewing machines (com.)—W. Hearmann. Artificial production of vanillin by means of coniferine, or the sap of plants belonging to the species of conifers, or any other plants related to this family, as an extract of all those parts of the just-mentioned plants containing coniferine.—C. L. Light. Railway and other wheels.—O. R. D. Morris. Apparatus used in coating metal plates with tin, or with other metals or alloys.—W. M. Scott. Breech-loading small arms.—W. Cotton. Means or apparatus for the manufacture of knitted fabrics.—R. Stone. Manufacture and mode of treating iron, and apparatus employed therefor.—W. Bown. Horse clippers.—M. H. Pearson and J. T. Pearson. Sewing machines.—A. H. Robinson. Meters for measuring water and other liquids, and motive-power engines, partly applicable to flushing waterclosets and preventing waste of water.—J. C. Ramsden. Machinery for spinning, doubling, twisting, or winding wool, silk, cotton, flax, or other fibres.—W. R. Lake. Loom harness, and machinery for manufacturing the same (com.)—J. Woodcock. Valves for regulating the supply of water to cisterns or tanks.—H. Beggeley. Manufacture of earthenware.

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On February 28th.—743 to 753.—J. D. Pinfold. Machinery or apparatus to be used in brick-making and stacking.—J. Saul and H. Hird. Economizing fuel by regulating the heat in the tubes of tubular steam boilers.—W. Batstone and C. Batstone. Economizing fuel, to be used as lining for grates, stoves, and furnaces, comprised of vegetable charcoal, coal, coke, cement, and clays.—T. Kendrick. Fastenings for shirt studs, sleeve links, solitaires, and other articles of jewelry and dress.—J. W. Price. Appliances for producing sound signals upon railways, especially during fogs and dark weather.—W. Steven. Brickmaking machines.—W. A. Lyttle. Means and apparatus for smelting iron.—G. S. Hughes. Journal boxes for railroad cars (com.)—J. E. H. Taylor. Construction of floors and galleries unheatable to above 212 degrees of Fahrenheit.—J. Mullinson. Steam and other cocks.—H. J. Coles. Fastenings for packing cases.

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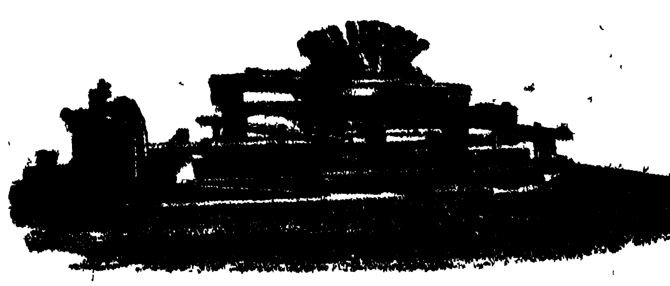

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THE

SCIENTIFIC AND LITERARY REVIEW,

AND RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

Journal of the Inventors' Institute.

[REGISTERED FOR TRANSMISSION ABROAD.]

VOL. IX.—No. 7.] (NEW SERIES.) JULY 1, 1874. [PRICE 6d.

*** Communications to the Editor to be addressed to him at 21, Cockspur Street.

CONTENTS.

APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur-street, Charing Cross.

On March 17th.—942 to 954.—J. B. Alliott. Construction and arrangement of engines.—G. Fowler. Tipping coal.—W. H. Northcott. Steam-engines.—C. Bennett. Protecting scarf pins and other articles.—W. J. Warner. Gas meters.—W. H. Stephens. Meal for fattening pigs, sheep, cattle, and horses.—T. Hydes and J. E. Bennett. Setting steam boilers.—R. George. Taps, valves, and stopcocks.—G. Dixon. Apparatus for preparing rope yarns.—J. Harper. Steam and air engines. (Complete specification.)—A. M. Clark. Signal hand lantern (com.) (Complete specification.)—A. M. Clark. Clothes hook (com.)—A. M. Clark. Electric telegraphy (com.)

On March 18th.—955 to 962.—H. Barrett. Spring brooch back.—F. Lürmann. Brickmaking machines.—P. P. F. Michel. Tannin.—J. Bailey. Working and locking points on railways.—C. Rutulini. Opening letters and other papers.—B. Wood. Cases or boxes, and arrangements of flaps or leaves thereon or thereto, for exposing advertisement.—C. Carobbi and G. Bellini. Locomotive and other motive-power engines.—W. R. Lake. Fire-escape (com.)

On March 19th.—963 to 979.—W. K. Brock. Billiard table.—E. F. Kingsley. Telegraph (com.)—F. Lebacq. Sardine boxes, without solder.—J. H. Carruthers and D. Rankine. Tramways.—J. Tangye. Raising or lifting the permanent way of railways.—W. R. Lake. Thrust-bearing for screw-propeller shafts (com.)—J. Evans. Anvils.—P. Liddicott. Plate warmer.—A. Barff and J. Kidd. Drying, charring, granulating, compressing, and burning peat.—J. B. Mirrlees. Pumping engine (partly com.)—W. Carnduff and G. McHarg. Cigars and cigarettes.—P. W. Willans. Steam engines.—A. M. Clark. Manufacture of chains and apparatus for the same (com.)—E. Marriott. Artificial fuel (com.)—T. Moy. Rings applicable to pistons and valves.—W. R. Lake. Devices for carrying metallic cartridges for breech-loading firearms (com.)—W. E. Prall. Apparatus for utilising compressed air in the management of railways.

On March 20th.—980 to 990.—B. F. Stevens. Castors (com.)—J. Imray. Apparatus for working [illegible].—P. Lawrence. Modes or means of and apparatus for extinguishing fires in ships, houses, and other structures.—J. Tay-wood. Railway keys and the means employed thereto, which is applicable to similar or other

purposes.—E. Heywood. Self-acting temples for looms.—J. J. Coleman. Preparation of fibres for spinning and weaving operations.—J. Barden. Steam gauges, pressure gauges, and vacuum gauges.—A. Pouillade. New system of horse-shoeing.—R. M. Caffall. Construction of portable and other commodes.—J. D. Kerr. Self-trimming apparatus adapted for loading vessels with coal, broken stones, grain, or other freight.—A. M. Clark. Mills for grinding coffee and other substances (com.).

On March 21st.—991 to 1001.—J. Howard. Self-acting apparatus for regulating the supply of water, and disinfectant for flushing and disinfecting waterclosets.—E. Tyzack. Securing the handles of table cutlery and other similar articles.—W. Lockwood. Valves for regulating the pressure of steam, air, water, or other fluid. —J. Reading. Connecting ornaments to collar and other studs, solitaires, and other drops fastenings and articles of jewellery.—W. Wilkinson. Construction of the hood or guard for the drum mouth of thrashing machines, and fencing or shielding the same.—E. Waterman. Construction of press, applicable to the stamping out of embossing of leather, and textile and other materials.—J. J. Hutinet. Hand-boring machines.—D. Payne. Printing machines.—W. R. Lake. Machinery for dressing or cutting, shaping, and finishing stone (com.)—J. G. Tongue. Book-sewing machines (com.)—H. Haskin. Apparatus for cooling liquids.

On March 23rd.—1002 to 1013.—A. Smith. Purifying water and preventing incrustation in steam boilers.—H. A. Bonneville. Battle telemeter (com.)—H. A. Bonneville. Apparatus for ascertaining and registering the distance which railroad and other carriages have travelled (com.)—J. Kaye and J. Kaye. Collecting and checking the money received in or on public conveyances and other places.—R. Milburn and H. Jackson. Steam generators and fire grates of steam generator and some other furnaces, applicable in part to water-heating apparatus.—G. A. Danet and X. C. R. Feuillant. Preserving animal and vegetable matters. (Complete specification.)—V. Lutschaunig. Steering-power of screw steamers, named the "screw rudder."—E. Morewood and J. H. Rogers. Tinning or coating sheets of iron or other metal.—E. Giampietro. Artificial tympanum.—P. J. Hendrix. Process of preserving lamps, cans, and holders containing petroleum or any other explosive liquid or gas from the possibility of exploding.—W. H. Chesebrough. Treating hydrocarbon oils and products (com.)—E. Tyer. Electric telegraph apparatus for train signalling on railways.

On March 24th.—1014 to 1027.—B. F. Stevens. Apparatus for facilitating the transport of casks and other articles (com.)—J. Kilpatrick. Constructions of gasaliers and reflectors, which latter are also applicable to other lights and gas jets.—W. W. Fyfe. Hydraulic rams.—J. Atkinson. Apparatus for stopping and regulating the flow of air, gases, or liquids through elastic pipes.—H. A. Done. Glove-fasteners.—A. M. Clark. Preparing grain for manufacture into flour (com.) (Complete specification.)—T. O. Kermode. Torch or flambeau for signalling on board ship and for other purposes.—O. H. Ellis. Boot-cleaning machine; part of such machine being applicable for other purposes.—W. Storer. Machinery and apparatus for washing scouring, wringing, and mangling.—R. B. Sauson. Machinery for cutting cloth and other materials.—J. Evans. Machinery to be employed in bending or turning up the strips or sheets of metal to be made into tubes.—W. N. Dack. Engines worked by steam and other elastic fluids.—G. V. Walker. Electrical train describer for indicating on a distant dial the names of trains, applicable also for other purposes.—P. G. Pout. Regulating and measuring the flow and discharge of water or other liquids for preventing waste thereof, applicable to waterclosets and other purposes.

On March 25th.—1028 to 1043.—W. [illegible]. Lavatories, baths, and urinals.—G. G. Rhodes. Railway brake, chiefly designed to be used for preventing collisions and other accidents.—H. Hathaway. Construction of furnaces, and the means of supplying air thereto.—C. R. B. Webb. Cask filling apparatus.—W. Radeke. Manufacture of peat, the method of drying and charring it, and structures and appliances to be employed for such purposes, being partly also applicable to the manufacture of artificial fuel. —R. Buckley. Check pick bracket in looms for weaving.—J. B. Clarke. Appliances for audibly indicating the removal from their ordinary stands of bottles and vessels containing poisonous substances.—W. S. Sedgwick. Automatic railway-waggon and carriage coupling.—W. Holland. Stretcher joints for umbrellas and parasols.—F. W. Clayton. Manufacture of waterproof paper, and apparatus therefor.—J. G. Willans. Manufacture of iron and steel, and ingots therefrom.—A. Van Waeyenberch. Distributing steam, and obtaining variable expansion through the agency of governors in steam-engines.—R. D. Napier. Friction meter. —A. W. Ledingham. Cleaning gas retorts, and apparatus therefor.—G. Davies and W. Lees. Fringing fabrics, and the construction of apparatus therefor, part of which improvements is applicable also to the manufacture of fringe, and part to ordinary sewing machines.—C. T. Colebrook. Pump valves.—J. Robertshaw. Looms for weaving.—A. C. Lewis. Furnaces for melting steel.—J. Wadsworth. Fire-lighters.—F. Weldon. Measuring or ascertaining distances to inaccessible and other objects.—A. M. Clark. Sewing leather (com.) —A. M. Clark. Artificial butter (com.)—W. M. Hall. Sealing letters and other enclosures.—E. A. Kirby. Manufacture of lozenges or troches, and the preservation in this form of animal and vegetable juices and extracts for nutritive, medicinal, and other purposes.—P. Jensen. Manufacture of gas (com.)—P. M. Parsons. Manufacture of steel or malleable iron and apparatus therefor.

On March 26th.—1054 to 1064.—G. Haseltine. Sheep shears (com.)—T. A. Nield. Taps or valves, adapted for use in controlling the flow or discharge of steam and other hot fluids.—J. Bradbury. Steam generators and arrangements in connection therewith.—P. C. Evans. Apparatus to be employed in connection with condensing, carding, and scribbling engines for preparing or treating wool and other like textile materials.—S. R. Krom. Machinery and apparatus for crushing ore and for separating crushed ores and analogous fine and granular material of different specific gravities. (Complete specification.)—J. C. Ramsden. Method or process of and apparatus for smelting, refining, melting converting, or purifying iron and other mineral or metallic substances.—G. Bennett. Flower and plant cases fitted for windows and other suitable openings in buildings, termed illuminated miniature conservatives.—S. H. Brown. Disinfecting and deodorizing apparatus for water-closets, and other purposes.—P. Jensen. Buffer and coupling apparatus of railway-carriages, trucks, and other rolling stock (com.)—T. J. Mirrow. Manufacture of waterproof plates or panels applicable for sheathing and roofing, and manufacture of packing and other cases, tanks, boxes, pails, cylinders, and such like from paper or other fibrous tissue prepared with cupro-ammonium. (Complete specification.)—R. D. Napier. Locks for securing switches and for securing railway gates, turntables, bridges, and such like.

On March 27th.—1065 to 1077.—J. C. Peacock. Apparatus for heating, lighting, ventilating, and cooking.—J. Keith. Manufacture of illuminating gas and the apparatus employed therefor. —T. Simpson. Construction of kitcheners or other similar apparatus, and the application thereto of parts designed for the purpose of economizing fuel whilst cooking, heating, or boiling water.—W. R. Lake. Machinery for cutting paper, and for the manufacture of paper-twine (com.)—F. A. T. de Beauregard. Packing of stuffing-boxes and pipe-joints.—J. Dawber. Arrangements and combinations of hollow fire bars, hollow bridges, and boxes, to be used for heating the feed water of steam boilers. —J. F. Clarke. Pneumatic signalling apparatus for use in buildings.—P. Jensen. Modes of and means for producing and utilizing gas and heat (com.)—S. G. Rhodes. Apparatus for gasing and reeling yarns.—H. A. Dufrené. Process for treating madder for obtaining and separating alizarine and purpurine therefrom (com.)—J. Chedgey. Apparatus for coating tubes and cylinders in glass, for [illegible] glass tubes and cylinders, and also for casing or fitting such articles to protect them from injury.—J. Lorne. Umbrellas and parasols.—S. F. [illegible] man and J. Bennett. Lamps for railway carriages and other purposes, and the method of arranging the [illegible] glass [illegible] in connection therewith.

On March 28th.—1078 to 1094.—E. de Zuccato. Producing fac-simile copies of writings, drawings, [illegible] (com.)—W. D. Nuttall. [illegible] and other purposes.—R. F. Boeving. Construction of ventilators.—H. Winter. [illegible] vehicles.—A. Mayer. Machinery for making bricks, tiles, and other similar articles.—T. Hillcoat and W. Montgomery. Steam-boiler and other furnaces.—J. Harrison. Means for signalling on railways.—J. Wood. Kitchen ranges, fire-grates, and other stoves.—M. Benson. Cushioning the piston and working the valve of direct-acting steam engines (com.) (Complete specification).—P. Pieri. Breech-loading fire-arms.—A. Howatson. Method of economising fuel in steam boilers and the means employed therefor.—J. H. Johnson. Apparatus for preventing or removing incrustations in steam boilers (com.)—J. B. Fenby. Vessels or apparatus for the infusion of coffee and for other like purposes.—G. Turton. Railway buffers.—G. Smith. Apparatus for consuming smoke.—R. L. Hattersley and T. Hebden. Means or apparatus for moulding and casting metals.—A. Warner. Manufacture of iron and apparatus employed therein.

On March 30th.—1095 to 1110.—C. F. Whitworth. Locks and latches and parts connected therewith.—W. A. Lyttle. Preparation and use of peat and peat charcoal for smelting and other purposes.—R. H. Urakmer. Motion indicators and governors for regulating and showing the number of revolutions per minute of marine and other steam engines and machinery whose parts have rotary and reciprocating motion.—M. Baerlein. Preparing yarn for weaving, and apparatus for drying yarn or cloth.—W. B. Gedge. Level (com.)—W. Meadows. Upright log and deal saw frames.—C. Eskrett. Means or apparatus employed in the manufacture of seed or oil cakes.—T. Halford and F. Bloomer. Apparatus for working railway signals.—W. P. Thompson. Furnaces and apparatus connected therewith.—J. Imray. Preparation of peat for fuel or charcoal, and apparatus therefor (com.)—J. Dewar. Ships' berths and arrangement of same, also mess tables, seats, and similar appliances connected therewith, and economizing space for cargo and other purposes on board ship.—G. A. C. Bremme. Valve gear or motion for steam and other motive-power engines and steam pumps.—B. Barnard. Tables. —R. A. Cowper. Process and apparatus for clearing and smoothing spun-silk, yarn, and other threads.—G. Haseltine. Looms for weaving narrow fabrics (com.) (Complete specification).—A. M. Clark. Apparatus to be applied to carriages for stopping or restraining horses (com.)

On March 31st.—1111 to 1132.—H. Geyler. Instrument to be used for obtaining fac-simile copies of letters and other manuscripts.—J. Plummer. Steam-boiler and other furnaces.—A. L. Dennison. Watches, clocks, chronometers, and other timekeepers.—J. Hinks and J. Hinks. Lamps for burning paraffin oil and other volatile liquid hydrocarbons.—D. Jones. Consuming or preventing smoke.—A. Haigh and J. H. Barrett. Taps and cocks.—J. N. Nuttall and S. Taylor. Railway chairs.—C. Smith and A. Alexander. Steam boilers.—W. Boulton. Machinery or apparatus to be used in the working or manufacture of potter's clay or other plastic material.—W. Sumner and D. Watson. Tubes for boilers and other purposes. —W. Darlow. Trusses, splints, and other surgical appliances employed for affording support to the human body or limbs.—J. Dodge and T. E. Coles. Furnace bars, and in the mode of mounting or setting furnace bars.—T. Balmayne. Kitchen ranges.—F. Wirth. Photographical portrait apparatus and other optical instruments (com.)—J. J. F. [illegible]. Framing and disposition of levers in apparatus for working and locking railway points and signals. —J. Willoughby, W. A. Southwell, T. J. Briggs, and S. Willoughby. Arrangement of pans or vessels, and of apparatus for heating the same.—[illegible] —W. R. Lake. [illegible] (com.)—G. [illegible]. Diamond [illegible] machines (com.) (Complete specification).—J. [illegible]. Method of heating animal charcoal for the purpose of re-burning or revivifying it.—[illegible]. Indicators for indicating the speed of revolving axles.—M. Henry. Manufacture of [illegible] [illegible].

(Continued on page 105.)

Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE.

JULY 1, 1874.

THE PATENT LAW REFORM MOVEMENT.

As the Patent Laws and Laws of Copyright are to us matters of primary importance, we consider we cannot do better than keep our readers well informed as to the state of them, and especially the former of these, for the latter receives so much attention from all the public journals, that we feel we need do little more than wish the cause of copyright amendment good speed. We therefore now devote our first page to detailing the steps recently taken to gain the attention of the Government to the present state of the Patent Laws, and the necessity for their amendment.

Early in the present year the Inventors' Institute made application to Mr. Gladstone, the Prime Minister, soliciting him to receive a deputation to explain the views of its members and other inventors on the subject; but, owing to the resignation of his Ministry, and the dissolution of Parliament taking place about the same time that this application was made, nothing resulted from it. However, soon after the advent to power of Mr. Disraeli, letters were written to him and the Lord Chancellor, respectfully asking that nothing should be done with regard to the Patent Laws until the Council of the Inventors' Institute had had an opportunity of advising with the great body of its members and inventors generally, in order to be able to state exactly what were the points in which patent law now required amendment. Directly upon making this last-mentioned application, the Council addressed a circular to all the members of the Institute (which we then published), desiring to know their views on the several points that have been found to be those constituting the subject to be dealt with. They also invited the members to conferences on the matter, all which, with full accounts of the results, we recently chronicled.

To give practical effect to these consultations, Mr. Campin, the Secretary of the Inventors' Institute, in pursuance of directions given him, addressed the following letter to Mr. Disraeli, and others to similar effect to the present Chancellor of the Exchequer and the Lord Chancellor, Lord Cairns:—

To the Right Honourable B. Disraeli, P.C., M.P. (First Lord of the Treasury):—

Inventors' Institute, June 4, 1874.

SIR,—Soon after the formation of the Government which you preside over I thereto made an application asking, as this Institute was considering the question of the amendment of the Patent Laws, that the Government would be kind enough to afford it an opportunity of placing before them the views of its members thereon, after the matter had been fully considered by them. As this has now been done I am directed to respectfully solicit you to receive a deputation to explain the nature of the amendments in the Patent Laws which are considered as urgently required, especially as regards the reduction of the stamp duty on Patents, and in doing so I may mention that these Laws have (since any legislative action thereon has taken place) been the subject of reports by a Royal Commission and a Committee of the House of Commons, many of the recommendations of which [illegible].

As [illegible] with the late Government we have been at a loss to ascertain what particular member of the Ministry we ought to address, we have, as well as yourself, addressed the Lord Chancellor and the Chancellor of the Exchequer.

I have enclosed a printed list of members of the Council of this Institute, with statement of objects, and I [illegible], to mention that, in consequence of its being considered that the Patent Laws affect the artisan classes (many of whom are inventors), this Institute has been co-operating with them, and that some representatives of those classes would attend the deputation.

From the great majority of the members of this Institute being located far away from London, I would ask that any appointment should give a few days for notifying them of it, and remain your obedient servant,

F. W. CAMPIN, Secretary.

To the letter to the Chancellor of the Exchequer the following answer was received:—

11, Downing Street, Whitehall,
June 8, 1874.

SIR,—With reference to your letter of 4th inst., in which you ask the Chancellor of the Exchequer to receive a deputation on the subject of the amendment of the Patent Laws, I am directed by Sir Stafford to say that he fears it would be of little use for him to receive a deputation on the subject, as his attention has never been directed to it, and he would suggest that the matter is more within the province of the Lord Chancellor, who is one of the Commissioners of Patents.—I am, Sir, your obedient servant,

JOHN A. KEMPE.

To F. W. Campin, Esq.

The Lord Chancellor (Lord Cairns) answered as follows:—

House of Lords, 6th June, 1874.

SIR,—I am directed by the Lord Chancellor to acknowledge the receipt of your letter of the 4th inst., asking on behalf of the Inventors' Institute for an opportunity of placing the views of that body and of inventors generally on the subject of the amendments in the Patent Laws before her Majesty's Government.

The Lord Chancellor desires me, in reply, to inform you that owing to the lateness of the period in the session at which we have arrived, and the immense pressure of the business which has to be got through during the portion of it which still remains, it will not be possible to legislate upon the subject of the Patent Laws until next year, and his lordship therefore thinks that there being, under these circumstances, no immediate hurry for the consideration of your proposals, it would be desirable to postpone placing them before him until a later period in the year, when the Lord Chancellor would have more leisure to entertain them in a manner satisfactory to your association and to himself.—I am, Sir, your obedient servant,

HENRY P. GRAHAM, Principal Secretary.

F. W. Campin, Esq., Secretary Inventors' Institute.

Reply from the Right Honourable B. Disraeli:—

10, Downing Street, Whitehall,
18th June, 1874.

SIR,—Mr. Disraeli desires me to acknowledge the receipt of your letter of the 4th inst. requesting that he will receive a deputation to explain the nature of the amendments required by the members of the Inventors' Institute to be made in the Patent Laws, especially as regards the reduction of stamp duties on Patents.

Mr. Disraeli, however, desires me to express to you his regret that the very great pressure of business prevents him from having the honour of receiving a deputation, but that if the views entertained by the Institute are addressed to him fully in writing he will be happy to give the subject his attentive consideration.—I am, Sir, your obedient servant,

CHARLES BAILLIE HAMILTON.

Thus it will be seen that the Government does not refuse to entertain the question, but puts it off to a more convenient season.

Reviews.

GUIDE TO HOUSE OWNERS.

"The House-Owner's Estimator; or, What will it Cost to Build, Alter, or Repair?" A price-book adapted to the use of unprofessional people, as well as for the Architectural Surveyor and Builder." By JAMES D. SIMON, A.R.I.B.A., Architect and Surveyor. Edited and revised by FRANCIS T. W. MILLER, Surveyor, with numerous illustrations. London: Lockwood and Co., Stationers' Hall-court, Ludgate-hill, 1874.

THIS is a very useful work for all who are interested in house property, whether in a large or small way, for by it they will be enabled to form a good idea of the money required to be spent over the most ordinary alterations, additions, and repairs, and can then count the cost before incurring it. Moreover, the work is not without promise of usefulness to the architectural surveyor, as it may be used to aid him in making rough estimates for the guidance of the notions of his clients in regard to any proposed new work. Although we have spoken of alterations and additions, yet it must be thoroughly well understood that the work is just as useful in regard to the erection of new buildings, for estimates are given for such erections.

We consider this will be found a very reliable work, as in all cases the prices appear to be fully up to the average, and we would just hint that, without resorting to that abominable being, the "scamping builder," probably anyone "about to build" would find that he could get the work done for a trifle less if he took the trouble to proceed in an economical manner. However, this is as it should be, for the competition amongst builders will always render promises of cheap work easily to be had; whilst the proper market price is difficult to discover, looking at the discordant aspect of the demands of the high-priced builder and the low-priced scamper.

The work also contains some useful practical legal information as to the position of landlords and tenants, the nature of the usual covenants in leases, and so forth. In fact, the only point in which the book seems to be open to improvement is the absence of direction and advice on that fruitful source of "difficulties" in building operations, the breaking of contracts, so as to turn contract work into work at ordinary prices. It might be observed that this is a posthumous work on the part of Mr. Simon. Unfortunately he departed this life before publication, hence, Mr Miller's services were called in. Perhaps the reader is advantaged by this. We have, to a certain extent, obtained the results of the knowledge of two competent men instead of one.

MAUNDER'S TREASURY OF NATURAL HISTORY.

"The Treasury of Natural History; or, a Popular Dictionary of Zoology." By SAMUEL MAUNDER, Author of the Treasury of Knowledge," "The Scientific and Literary Treasury," &c. Revised and corrected, with an extra supplement, by E. W. H. HOLDSWORTH, F.L.S., F.Z.S., &c; embellished with more than 900 woodcuts expressly engraved for this work. New Edition. Longmans, Green, and Co. 1874.

THE present volume is a new edition of a well-known and popular work, and when we use the latter term, we do not mean to convey that it is a work suitable only for those who wish to become amateurs in this branch of science, for the information contained in this book, although necessarily restricted to generalities rather than details, and affording, as it does, specific information in ordinary language, with the least possible use of scientific terms, is nevertheless a complete scientific compendium of Natural History, adapted for popular use in a form available for ready reference, though it is, at the same time, a handy book for refreshing the memory of the scientific man.

SEA WATER FOR LONDON.

"Sea Water for London: a Scheme for Carrying Sea Water from the Coast Direct to the Metropolis." By CHARLES FREDERICK FULLER, C.E. London: Charing Cross Publishing Company, Limited, 5, Friar street, Broadway, E.C. 1874.

THIS pamphlet advocates the construction of a brick sewer way by the side of the London, Brighton, and South Coast Company's line to a convenient spot near the London terminus, were baths, on a large scale, would be erected on the principle of Brill's Baths at Brighton. This admirable establishment, says the author, I may mention, consists of extensive swimming and private baths, billiard rooms, &c., on a most liberal scale, and it is not too much to say that one of the greatest luxuries one can enjoy is a hot sea bath at Brill's. I shall, then, adopt this establishment as my guide, in discussing the possibility of forming a similar one in London.

In the first place, then, it would be necessary to construct a pumping station at Brighton, as closely as possible to the sea. An engine would pump water into supply tanks, and from thence it would find its way to the main, through which it would be conveyed to London, and again find its way into storage tanks for use.

By the process of steam pumping, a constant supply of sea water would be always at hand, and the inhabitants of this great metropolis supplied with a genuine sea bath at home. The diagram shows the course proposed to be taken, the red lines representing the main. The direction shown, is as nearly as possible that of the London, Brighton, and South Coast Railway. I have calculated that about 270,000 gallons of water would be consumed per day, supplying two large swimming baths, and, say, twenty private baths An engine of thirty-horse power (nominal) would be sufficient to raise this and to pump in into the storage tanks. These tanks would be of iron, and would require to hold, between them, about 100,000 gallons of water. They would be fixed in a pumping-house, in as close proximity with the sea as possible. This pumping establishment would not require to be a very extensive affair, as it would only comprise the tank houses, engine room, and engine-driver's cottage.

The water main from thence would be constructed of brick-work in cement, on a foundation of concrete. This would be laid at a depth of three or four feet from the surface of ground. In crossing bridges, &c., the main would be carried on girders, built into the abutments of the bridge. The establishment in London would consist of a building on a large scale, consisting of swimming and private baths, dressing rooms, &c., and it would also be an interesting feature to add billiard and reading rooms, coffee rooms, &c., in short, an establishment long wanted in London, that only requires a few enterprising individuals to embark their energies in such a channel to set it going at once

The machinery department in London would consist of large storage tanks (into which the water would find its way from the main). These would ensure a fresh supply of salt water to the swimming baths daily, and would be amply sufficient for the private baths, should the demand be ever so great. An engine of about twenty-horse power (nominal) would be ample for this establishment.

Now, the cost of raising water by means of steam pumping, say a height of twenty feet, is about twopence per thousand gallons. The price being the maximum, it would, most probably, cost very much less. I have gone carefully into the various difficulties to be mastered, the amount of labour involved, together with the cost of carrying out the scheme, and I have come to the conclusion that the total cost would not exceed £500,000.

The brick main would cost the least of any method. Cast-iron pipes could also be employed; but the cost would be very much more, and they would also be very much impaired by the action of the salt water. It would probably be found necessary, however, to use cast-iron pipes in certain places. For instance, where the main would pass over a viaduct, and there is not sufficient depth to allow of the foundation for the water-way, then probably the best plan to adopt would be to carry the water through cast pipes while crossing the viaduct, and again convey it to the main.

There are several difficulties to be got over in this great undertaking, but none that are insurmountable; and I firmly believe that should the suggestion ever be attempted, success will attend the venture. It would in reality be only a matter of cost, and the modest sum I have named cannot, I feel sure, be deemed too large an outlay for a scheme at once so noble and so healthful.

It would undoubtedly be a boon to the people, and more particularly to the faculty. The author afterwards refers to a plan for bringing here sea water from Shoeburyness, which, in some respects, he considers even better than that above described.

FOOD ADULTERATION.

"Adulterations of Food, with Short Processes for their Detection." By ROWLAND J. ATCHERLEY, Ph.D., F.C.S. W. Isbister and Co.

THIS is a very useful little book, appearing at a time when the subject of adulteration is of so much importance. Dr. Atcherley has supplied a want much felt at the present day. His book contains practical tests, as well as a carefully compiled description of volumetric solutions; equally useful to the consumer, the dealer, and the professional chemist. The tests for the adulteration of butter, coffee, beer, and tea appear good. We are, however, disappointed at the little notice taken of an article so largely adulterated as vinegar; it is now impossible to procure a sample of pure malt vinegar; what is now sold is made solely from acetic and sulphuric acids; of the latter the Legislature permits 1 to 1,000 by weight. The majority of grocers now make their own white vinegar; the acetic acid in its pure state is supplied to them by the manufacturers, after which it is diluted to the required strength with water. Dr. Atcherley states that he has examined several samples of corn flour, and that he has found them to "consist of corn flour only in its pure and unadulterated form." We cannot reconcile this with the evidence given by Dr. Bartlett before the Select Committee, viz., that all corn flour is adulterated, and that caustic soda is used to destroy the nitrogenous portions of the flour; this may be done in this country, but we know that the Oswego corn flour manufactured at New York is fermented alone with pure water.

Some analysts state that spirits are little adulterated, especially whisky. Now, there is no article more adulterated than whisky. Let any analyst go to some public house in one of our leading and less fashionable thoroughfares—it is here where adulteration is rife—and take the poison that is supplied to him from the counter to be drunk on the premises—for it is well known that the whisky or spirits of any kind that a publican supplies in this manner is a very different article to that which he allows to leave his premises—and he would meet with an adulteration that would surprise him, especially of methylated spirit. Dr. Atcherley states that this adulteration is difficult to discover, except by the practical man:— "He rubs a few drops of the liquid on the

palms of his hands, and, applying them loosely to his face, inspires the air through his fingers. By this means the aroma of the spirit is fully brought out, and the "twang" of the wood-naphtha easily recognised."

We congratulate Dr. Atcherley on the publication of this book, and recommend it to all who desire to gain some useful information, in a practical and condensed form, respecting the adulteration and analysis of food.

ANCHORS FOR THE ROYAL NAVY.

"The Admiralty Anchor Scandal." By JOHN TROTMAN. London: Hutchings and Crowsley, Printers, 39 and 41, Henry-street, St. John's Wood. 1874.

MR. TROTMAN, in this pamphlet, comes boldly forward to denounce the conduct of the Admiralty in the matter of his anchor, and everybody who knows anything about the treatment of inventors by Government Departments will read his statements with a readiness to believe in their truth and soundness. We cannot go through all these, though they are well worthy of perusal by all inventors, especially those whose ingenuity leads them to devise improvements for use by Government Departments. The following passage will, we think, give the reader a general view of the strength of Mr. Trotman's case:—

The Admiralty, in fact, prove too much. If the Trotman anchor has the serious and fatal defect imputed to it, why is the safety of the most sacred and illustrious life in these Islands entrusted to it? If the "professional adviser" instructs Mr. Goschen to say that the Trotman anchor "cannot be depended upon for biting and holding when first let go," how can he reconcile it to his loyalty and duty to the Sovereign to allow it to be used on board the royal yacht? What uneasy, restless nights the "professional adviser" must have whenever her Majesty or the Heir Apparent is at sea? "Here we have in our dockyards" (we may suppose him to say to himself) "a Navy anchor which always bites and never drags, and yet I have allowed the Queen and Royal Family to go to sea solely dependent upon a Trotman's anchor, which I know, of my own knowledge, and which all the officers of the Royal Navy declare cannot be relied upon for biting or taking hold at the critical moment." What miserable nights such a First Sea Lord must have passed We should almost think that he has ill discharged his duty in not going down to Portsmouth whenever her Majesty returns from Antwerp, Ireland, or Cherbourg, and ordering the Trotman anchor to be put bodily on shore out of harm's way. "Oh! I have had such an uneasy time since you have been away," we can imagine him saying to the captain of the royal yacht. "How did your anchor behave?" We know what Admiral Denman's answer would have been, because we have his evidence upon the Trotman anchor. Reproduced textually, and only put into colloquial form, his reply would have been;—"Don't make yourself uneasy, Admiral. Trotman's anchor always bites and holds perfectly. It has never failed me in any way. It is vastly superior to your Admiralty anchor in every respect, and if you transfer me to-morrow to the largest of our line-of-battle ships, I should, for many reasons, be most anxious to have Trotman's anchor. I really cannot understand, Admiral, why the Admiralty have not more readily supplied these safe and most efficient anchors to the Navy." If the "professional adviser" had betaken himself to Captain Crispin or Captain His Serene Highness the Prince Leiningen, G.C.B., who together have been answerable for the safety of the royal yacht for nearly twenty years, he would have heard similar testimonies to its unfailing efficiency.

If any accident had occurred to the life [illegible] through any default of the anchor on board the royal yacht, we know quite well how eagerly the First Lord of the Admiralty and his First Sea Lord would excuse themselves. "We gave her Majesty (they would say) the protection of the very best anchor which modern science has produced—an anchor which, after the most rigid comparative tests, conducted by the very best committee which England could produce, was unanimously declared to be the best and most trustworthy in the world." The Admiralty would be thereupon excused and acquitted before any Court of Inquiry in the world, except for the evidence supplied by their own prejudice and inconsistency. What answer could they make to the inquiry? "Why, then, have you not supplied this anchor to the Royal Navy?"

The irrationality of the Admiralty is indeed an affront to common sense. The Trotman anchor has secured for twenty years the safety of the royal yacht *Victoria and Albert*, of 2,345 tons, and if it be not the best anchor that can be had for a ship of that size, somebody's head ought to be brought to the block on Tower Hill. Assuming that it is the best anchor, why have not the Admiralty ordered it to be supplied to every ship of and below that tonnage in the Royal Navy? The First Lord one day, and the Secretary to the Admiralty another, tell the House of Commons that although the Trotman anchor may be good for a yacht, it may not be best for a man-of-war or line-of-battle ship. Would it not be supposed that the Admiralty, after supplying it to all vessels of and under 2,345 tons, would make tentative experiments by supplying it to ships of larger tonnage, and directing it to be tested comparatively with the Navy anchor? If for a period of fourteen years it has never yet failed on board the *Great Eastern*, of 23,000 tons, is there not *primâ facie* reason to believe that its action would be equally and always certain "both as to biting instantaneously and holding most tenaciously" the largest iron-clad ship afloat, say of 5,000, 6,000, or 7,000 tons? It is, however, an insult to the understanding of my readers to argue this question seriously. It is on the one side a question of logic, common sense, and economy; on the other of mere official or personal prejudice on the part of the "professional adviser" to the First Lord of the Admiralty. I can not only appeal to some 20 years' experience of the Trotman anchor at sea in the royal yacht, but to the accumulated experience gained by the use of upwards of 60,000 other Trotman anchors, all of which are, more or less, in daily use in every quarter of the globe, on board the well-found yacht, the *Great Eastern* steam-ship, and whole fleets of truly magnificent ships belonging to all the great shipping companies of the world, such as the Cunard Service, the North German Lloyds, &c., &c.

"THE MARBLE ARCH."—We have received two monthly numbers of this promising addition to our periodical literature. Amongst the contents we note a very suggestive article comparing the writings of Dickens and Thackeray; and in its original column, biographical column, (which is filled by a life of Handel), its historical column, literary column, educational and scientific column, musical review column, and obituary column, much interesting reading will be found. A noteworthy feature is the distribution with this work of a piece of music by Handel, usual folio size, in a handsome wrapper, and published apart from the magazine. The work emanates from the Ladies' Printing Press, 48, Hunter-street, W.C.

NEW READING GLASS.—Mr. Lewis Jackson has recently registered a design for a new reading glass, which enables a whole line or several whole lines of print to be read without movement of the glass.

SMEATON'S COMBINED HEATING AND FIRE EXTINGUISHING APPARATUS.

THIS invention consists in certain combinations and arrangements of apparatus whereby supplies of hot and cold water to houses and other buildings can be brought into operation simultaneously, and rendered available for the extinction of fire, a larger quantity of water being thus obtained and with greater certainty in any case of sudden emergency than by any of the arrangements hitherto in use.

Hot and cold water reservoirs are respectively fixed in the most elevated available part of the house or other structure, or, if desired, they may respectively be placed at different levels. The hot water reservoir is supplied with heated water by means of main pipes from a boiler in which the water is heated by a furnace or other suitable means, as well understood. Tubes are connected with the main pipes, by means of which the heated water may be conveyed to any desired part or parts of the house or building, and so employed for heating purposes, as well understood. The cold water reservoir is supplied with water from the street main. The cold and hot water reservoirs are respectively connected by means of a pipe or pipes furnished with a self-acting double action valve or valves for the purpose of allowing the whole of the water contained in the respective reservoirs, which are thus combined, to be made available at any moment, the valve or valves opening or closing according to the pressure exerted thereon by the body of water in either reservoir, and thus allowing it to descend through the respective pipes connected therewith, and which are respectively carried through the several parts of the building. Hydrants or branches to hydrants, provided with suitable cocks, to which hose can be attached, are connected with the tubes at any desired points, and from which a supply of water can be at once obtained, in case of a fire occurring. A self-acting double action valve is provided in connection with the heating apparatus, by which the cold water from the street main is prevented from passing into the same, but allowing the heated water to pass into the cold water pipes, and so to be available for the hydrants, as before mentioned. In immediate connection with the street main is a self-acting double action valve, by which the whole of the water in the reservoirs and pipes is retained therein, in the event of the supply from the street main ceasing, or the pressure thereof being reduced below that exerted by the column of water between the last mentioned valve and the reservoirs. Vertical hot water main pipes from the boiler are connected with a safety expansion box in proximity to the hot water reservoir and a self-acting double action valve is placed in proximity to the cold water reservoir (which is also provided with a ball cock) by which the supply and exhaust of cold water thereto is regulated.

In the case of an excess of pressure from the street main over that derived from the column of water in the reservoir, the whole force of the supply from the street main can be made available without interfering with the hot water apparatus. It is also manifest that the hot water alone may be employed independently of the cold water supply.

The reservoirs may be respectively duplicated or used in any desired number, and the respective valves are of such sizes and forms as are necessary or expedient for the purpose or purposes for which they are to be employed.

In some cases, such chemical substances as are capable when brought into a gaseous or vapourized state of extinguishing fire, are placed in the hot water reservoir, and are thus most usefully employed, but even when such substances are not so employed, the steam and vapour resulting from the use of

heated water materially assists in the effectual working of the apparatus.

It will be manifest that the apparatus which forms the subject of this invention is greatly superior in point of efficiency, power, and certainty of action to any methods hitherto employed for the like purpose, it being applicable to every description of building, and it should be mentioned that an important feature in connection with it is, that it can be readily added and adapted to apparatus already erected for the supply of hot and cold water.

The proprietors are J. G. Smeaton and Co., heating, ventilating, and hydraulic engineers, patentees and manufacturers, Harwood-road, Fulham, London, S.W.

COCOA AND ITS MIXTURES.

The discovery of cocoa by Columbus, at Trinidad, in the year 1498, was an important era in the manufactures of this country; probably no article of food and drink has monopolised a greater share of industry as a staple manufacture.

The great botanist, Linnæus, who was very fond of a drink made from its seeds, named it *Theobroma Cacao*, and deemed it as a "food fit for the gods."

There are several growths of Cocoa, all indigenous to the tropics, but the finest comes from Trinidad; the West India Islands supplying the chief importation to this country. It would be difficult to conceive a more charming sight than the cocoa gardens at Trinidad when in full bloom. Any one who has seen our rich apple orchards in Kent at the early stage of blossom, to which they may be likened, can form but a slight comparison. These luxurious flowers of rich pink and saffron colours, resting, as it were, on the bright-green foliage of the leaves, and shaded by the tall majestic palm trees, form a picture which can be witnessed only in a tropical clime. The average height of the trees is thirty feet, the wood is porous, and the bark of a light brown colour. The flowers being much too numerous are considerably decimated as they arrive at maturity, the more hardy ones only yielding fruit; a single pod of which yields a large number of seeds. In planting the trees great care is necessary in the selection of soil, which must be rich and well irrigated. The trees rarely produce fruit until the fifth year, and are not matured until the eighth or tenth, when they yield a plentiful crop. There are several methods of drying the seeds after taken from the pod, but they are generally placed upon mats made from the *Cocus nucifera* (cocoa-nut tree), and left to dry in the sun. These mats, which generate much electricity, soon render the cocoa fit for exportation.

Cocoa, as an article of food and drink, cannot be too highly appreciated; in nutritive power as a nitrogenous and carbonaceous food it has no parallel. It combines, indeed, in a concentrated form, all the essential elements for the support of the human body. The following shows the average analysis*: —

Fat (cocoa butter), 50·00; albumen, fibrine, gluten, 19·00; starch, gum, 18·00; water, 5·00; theobromine, 2·00; salts, 4·00; colouring matter, 2·00; total, 100·00.

The manufacture of cocoa in Europe was first commenced by the Spaniards early in the fifteenth century. It is difficult to determine when it was first introduced into this country, but there is no doubt, through England being the mart of the world, that Columbus was the first to introduce native manufactured cocoa here. It is a fallacy to suppose, as many do, that the Spaniards were the first to manufacture the nut or seed, from its virgin state into the form of paste. The earliest records we have of the Island of Trinidad, is, that the natives there were in the habit of grinding the nut, or seed, between stones, and afterwards adding sugar and spice until it became a paste. This crude practice is followed to this day in its primitive state.

Dr. Sloane (afterwards Sir Hans Sloane) is said to have first made known the method of manufacture in England. But when mechanical appliance was first brought to bear upon his knowledge is doubtful. To Mr. Dunn, of the firm of Messrs. Dunn and Hewitt, whose factory still stands on Pentonville-hill, we are indebted for having converted cocoa into such a nutritious article of food and drink. After a long series of experiments, he succeeded in producing a substance in the form of a paste, from which have arisen the various cocoas and chocolates of the present day.

Whether the manufacture of cocoa to a soluble state with arrowroot, improves it as an article of diet, is doubtful; it is certain that dyspeptic persons find the fatty substance difficult to digest, whilst, when utilized with starchy matter, it may be generally used, and is brought within the reach of all. When, however, taken in this state, it should be *always first boiled*. Of the varieties of cocoa manufactured by Messrs. Dunn and Hewitt, the "Iceland Moss" claims the best attention. The nutritious properties of the moss are well known, and when combined with such an article as cocoa, it forms a delicious dietary drink.

At present there appears to be little cocoa sold in its pure state, some manufacturers are, however, pushing it into the market, and it meets with an increasing sale. Of this, a very excellent article is manufactured by Messrs. Cadbury Bros., which combines all the properties of the cocoa nut in a condensed form, and is much recommended by the faculty. Of Continental cocoas introduced here as pure, we have Van Houten's; this is prepared almost to an impalpable powder, which makes it easily soluble; by this means the full aroma and strength of the nut is brought out. It is rich in cocoa butter, and makes a light and nutritious article of drink.

The consumption of cocoa is rapidly increasing; during the past year, the Custom House received duty on no less than 8,311,032 pounds. These figures alone should be sufficient to prove the virtue of an article, the most wholesome of all beverages.

* This compares favourably with Dr. Lankester's, which is the analysis generally received.

H. W. PENDRED'S ELASTIC SCREW PROPELLER SHAFTS AND THRUST BLOCKS.

At the meeting of the Inventors' Institute, on May 28, Mr. H. W. Pendred, C.E., read his paper on the subject above-named, in which, after some very interesting remarks on the general question of the desirability of elasticity in propeller shafts, and improved construction of thrust blocks, he proceeded as follows: —

I come now to that portion of my paper which is the most difficult, because it is the part dealing with a device of my own. I will endeavour, however, to be as brief—consistently with putting my application of a principle as clearly as may be—as I can. I must also beg to impress upon all now present, and who have heard me thus far with patience, that I do not claim for my invention—if, indeed, invention it can be called—anything more than that it is a step in that direction in which we ought to travel in the future of screw steam navigation. We should have an elastic, a really flexible propeller, flexible in each portion of each blade, as well as that flexibility in the shaft which will allow the propeller, while actuated by the engines, to have a certain amount of independent action, such as will free it from the great strains caused by the momentum of the reciprocating parts of the engines in board, such strains being at present often exerted at the worst possible moment—when the screw is perhaps drowned in the roll of a wave. The latter flexibility is that to which I now confine myself, coupling it with the kindred elasticity provided in a longitudinal direction. My reason for hoping for good results in the way of a reduction of vibration, combined with economy of power, is this: a flexible propeller blade need be only flexible in the direction of rotation and in the direction of its axis, no elasticity in the direction of its diameter is required; that a fish is flexible longitudinally, because it can stiffen its tail or fins at pleasure, so as to increase their propelling power of action; if moving slowly, the tail is not alone urged feebly against the water, but the pitch, regarding it as a propeller blade is reduced, and thus we find longitudinal elasticity; the elasticity of the tail in the direction, as I will call it, of rotation, is too familiar to need comment. Well, then, failing any present means of making a screw propeller whose blades shall resemble the true fish-tail action, I try that which, while I am conscious of its imperfection, is the next best thing. I provide two elasticities within the ship, where we can measure fairly the strains to be dealt with, and where breakage can be repaired. These elasticities provide the two which I have considered above as being necessary to obtain an approximation to the fish-tail action. At present I can only rest my hope of successful results upon theory, backed up by nature's arrangements as precedents under analogous conditions.

The mechanical arrangements whereby I secure elasticity in the two directions are very simple. I have studied to make them so as much as possible, for of course all mechanism on board a ship ought to be simplicity itself. The repair of breakages, when a ship with hundreds of persons on board is tossed like a cork on the waves of the Atlantic, must be a matter of minutes, otherwise they are likely to be too late.

The drawing and models show very plainly the principle of my invention; indeed, I do not advance the design illustrated by the sketches as the only or even the best methods of securing the two elasticities. When the invention comes to be practically applied, it is almost certain that we will find some methods of construction as well as certain degrees of elasticity give the best results, but these can only be arrived at by the tentative process of experiment.

I will proceed to refer to the models.

No. 1 illustrates the construction for large ocean steamers and war ships.

No. 2, the plan for small vessels, such as yachts, steam launches, *et hoc genus omne*.

No. 3, the plan for the repair of broken shafts at sea.

In No. 1 it will be seen that I divide the propeller shaft from the engine shaft. They are, in effect, as separate from each other as a locomotive is from the train for which it is getting up steam to draw to its destination. I call the one portion the engine shaft, the other the screw shaft. I fit the thrust blocks, as a matter of course, to the screw shaft, and it will be seen that instead of bolting them as rigidly as possible to the ship's hull, I arrange them to fit guides similar to those of a locomotive piston-rod as provided for [illegible] engines. [illegible] and these [illegible] in the [illegible]. On the forward portion of the [illegible] I fit [illegible] cylinders, [illegible] I place [illegible] buffer-springs, while in the after [illegible] of the [illegible] I place indiarubber blocks or other [illegible] to [illegible]

[illegible]

When all is at rest the [illegible] draw-bars of a railway carriage keep

them drawn till their shoulders rest against the frames; as soon, however, as the screw is rotated, and acts to force the ship ahead, the thrust-blocks tend to urge the vessel through the medium of the springs, and the longitudinal action of the screw is, to a certain extent, quite independent of the movements or resistance of the hull. This independence I regard as one feature promising to reduce vibration. This supplies longitudinal elasticity. I now refer to torsional elasticity. This I provide in even a simpler manner than that which I propose for the "thrust." For large vessels, as shown in No. 1, I fit a fixed disc on the screw-shaft; this disc has notches in its periphery radiating from the shaft in the centre, and they are rounded on the surfaces against which the flexible slips or blades bear, so as to give the greatest freedom of action to the latter. This disc is surrounded by a steel hoop, purposely omitted in the model to make the action of the blades more clear. On the engine-shaft I put a similar disc, but it is so fitted that it can be shifted at pleasure along the shaft, one or more feathers securing rotation with the shaft. The steel hoop of this disc has a set screw over each notch, and it will be seen that no cut or hole is made in any of the flexible blades, so that the strength of each is unimpaired, and it is simply run into place in the engine disc and secured by the set screw. The reason I make the engine disc free to be shifted, is to enable the engineer in charge to regulate the amount of torsional elasticity to suit different conditions of weather and speed. Model No. 2 does not contain any provision of this kind, as I do not think it probable that it would be much needed in little vessels, but it could be adopted if requisite. Model No. 3 represents another branch of the subject under consideration. Nos. 1 and 2 represent means proposed for the joint objects of economising engine power, and preserving shafts from fracture. No. 3 illustrates a method I propose for the repair of fractures occurring at any point, other than in or very close to the journals. As will be seen, I propose the use of a section of shaft other than circular, and putting thereon a loose sleeve of steel, which is placed on each length of shaft when the shaft is first made, if the shaft gives way the engines are stopped, the sleeve run up to cover the fracture, secured with a wedge or set screw to prevent shifting, and the shaft can once again be rotated by the engines.

I must now proceed to a short analysis of the practical working of the schemes, and I will return to model No. 1, and consider first the torsional action. Some practical men will probably say that the objection to the cage of flexible blades would be, that either they will break across if made light enough to give sufficient flexibility, or else no appreciable torsional flexibility will exist at all. I cannot myself think that this sort of objection has real foundation. In a sense, the blades are cantilever springs, and from the fact of each being a single leaf-spring, and working quite independent of its fellows, no loss of flexibility takes place from the great friction ever present in large heavy springs built up of several leaves; besides this the amount of flexibility is capable of the nicest apportionment; it can be regulated both by the number of blades used, and by length of cantilever worked between the two discs; hence I am strongly of opinion that a very great amount of torsional flexibility may be hoped for [illegible] in the [illegible] Next I turn to the thrust-block [illegible] here I claim for the scheme [illegible] advantages I have not yet adverted to. I believe every practical engineer who has had to do with marine engineering knows that the task of "centring" all the bearings of a long screw propeller shaft is no easy one; the *bete noire* of the chief engineer of a large steam ship are "hot bearings;" they are, in a sense, the destroyers of his peace of mind; his "Nemesis," which "dogs" him, sleeping or waking. Hot bearings in paddle engines, where the shaft is comparatively short in proportion to its diameter, are unfortunately but too common; the evil is of necessity increased as the length in proportion to diameter is added to, and the journals are placed further apart. The india-rubber water pipe, with its nozzle over each bearing, is the marine engineer's skeleton, perpetually reminding him of his lurking foe. As the Ashantee savage was to Sir Garnet Wolseley, so is a hot bearing to an engineer in charge. The evil of the difficulty of truly centring a long shaft on a rigid foundation is greatly enhanced on board a steam ship. A long screw steam ship is, as referred to the screw shaft, nothing other than a girder uniformly loaded while the ship is afloat in dock; if the engines are then at rest (and as a matter of course they are so when the shaft is being centred) the conditions for the erection of machinery are the same as in a land structure; but immediately the engines are set to work a certain set of cross and alternating strains are called into action in one particular part of the ship or girder, which must, in the nature of things, exercise a certain influence on the shape of the girder and consequently on the centring originally correct, or, if my audience will allow me to borrow a phrase "in tune;" these strains of the engines, being localised, too, tend in some degree to put the centring of the shaft in its bearings "out of tune," and hot bearings are the natural result. Well, in my scheme, the shaft is divided into as many separate lengths as there are cages employed, and the cages answer to universal joints, leaving each pair of bearings to themselves. Well, now, if the mere action of the engines in smooth water have a tendency to put the shaft bearings "out of tune," what may not be anticipated from the complicated strains of the waves of an Atlantic sea-way? Overworked engines, and a screw alternately threshing the sea and rotating in the air, bearings must needs be secure and the ship stiff, to keep journals "in tune" under such working conditions.

I now come to the thrust strains. Marine engineers know the trouble the crank pin bearings give them. These, like the shaft bearings, are hard to keep cool, and demand constant attention and lubrication, even when no end strains are exerted on the shaft as in paddle engines. The evil is aggravated in screw shafts as now fitted; the propeller converts the entire indicated horse power of the engines, less frictional and vibrational waste, into end strain on the shaft, which strain is or should be received by the thrust blocks and transferred to the hull of the ship. To do this effectually, however, the thrust blocks must be not merely secured to the hull between the screw and the engine cranks, but they must be positively incorporated with it. The evil effects of girder deflection under varying strains referred to as putting the shaft bearing centres "out of tune," do not practically, in my opinion, operate here, because the cross section of a steam ship, regarded as a girder, must be to all intents unyielding, owing to the extravagant excess of the depth represented by the vessel's length of the girder over the span as represented by her beam, no appreciable deflection can be possible; but the thrust blocks cannot at least with our present constructive appliances be incorporated by welding with the ship's hull; therefore, bolts and rivets are all we can rely upon, but when we consider the magnitude and constantly varying nature of the thrust strains on thrust blocks as at present fitted, it becomes obvious that the most careful and skilful workmanship, and the best materials are essential to so secure non-elastic thrust blocks as that no strain shall come on the crank pins.

Hot crank pins in screw shafts arise from either of three causes, viz., brasses set too tight, defective lubrication, or distortion of the crank pins, either from original bad workmanship, or from strains received by them from the screw which of right belongs to the propulsion of the vessel, and should be absorbed by the thrust blocks. Well, then, if my hearers will examine model No. 1, they will see that no end thrust can by possibility reach the engine cranks. The engine shaft has no motion save its legitimate one of rotation with the screw shaft, consequently at least one source of hot crank pins is eliminated from the engine room.

I now come to the final feature of my invention, the provision for repairing broken shafts at sea, even in heavy weather. A letter from Mr. Cook, the well-known tourist agent, was published about a fortnight since in the *Daily News* about the breakage of the screw shaft of the [illegible] in the Atlantic, about 1,000 miles from Greenock, and how the shaft was so repaired that the vessel steamed home to Glasgow in safety. I went to Mr. Cook's office, and was courteously shown a letter of his own, describing the nature of the fracture and its repair; the fracture was obliquely across the shaft through an old flaw; the ship was fortunately in a dead calm at the time, and the chief engineer, to give occupation to his staff, set them to try and mend the broken shaft; and Mr. Cook stated that in nine days three "holes were drilled through the oblique fracture, the diameter of the shaft being 14 in.;" these holes were plugged with iron or steel pins; clamps were put outside, steam got up, and a speed of from five to seven knots an hour was maintained for the thousand mile run to Greenock. Of course, if there had been any great sea way on, there would not even have been time for the repairs, for the safety of the tremendously long ocean steamers now built depends on their having steerage way; if they lose this they are in terrible jeopardy, because they "sound" off into the trough of the sea, and if they cannot run before the wind the waves simply beat them under the water, and they founder, consequently any repairs to machinery to be effective must be done in, if possible, a few seconds, at all events in a few minutes; the seconds are best, because the ship has not lost her "way," and can be kept out of the trough of the sea; when minutes are occupied, way is lost, and the ship will get into the trough; but then "way" may be again got on her; and though it is a fearful task to get a heavily-laden steamship—whose length is perhaps ten times her beam—head to wind after she has broached round into the trough of an Atlantic sea way, yet it may be done with skilful steering and an able captain. Consequently, if screw shafts can be repaired expeditiously and effectually, the knowledge that the means for such repair is provided will tend to cheapen insurance premiums, encourage passenger traffic, and enhance the value of screw steam navigation.

In conclusion, I must beg to remind my hearers that I do not advance my own inventions as being the best means of overcoming acknowledged evils in a great means of transport. I only claim for them that they are, so far as I know, a step in a direction never yet followed by marine engineers, and that possibly others, as well as myself, following up the matter may do much more to improve and add to the *comfort*, the economy, and the safety of screw steam navigation.

In the discussion on this paper (for which we cannot now find space), Mr. F. H. Varley and Mr. Furness took part, referring to some inventions of theirs for effecting similar objects to Mr. Pendred's; also Messrs. Calley, Murray, Carttar, Campin, and the Chairman. After votes of thanks to Mr. Pendred, and the Chairman, the meeting terminated.

ILLUSTRATIONS OF MR. PENDRED'S INVENTION.

Fig. 1.

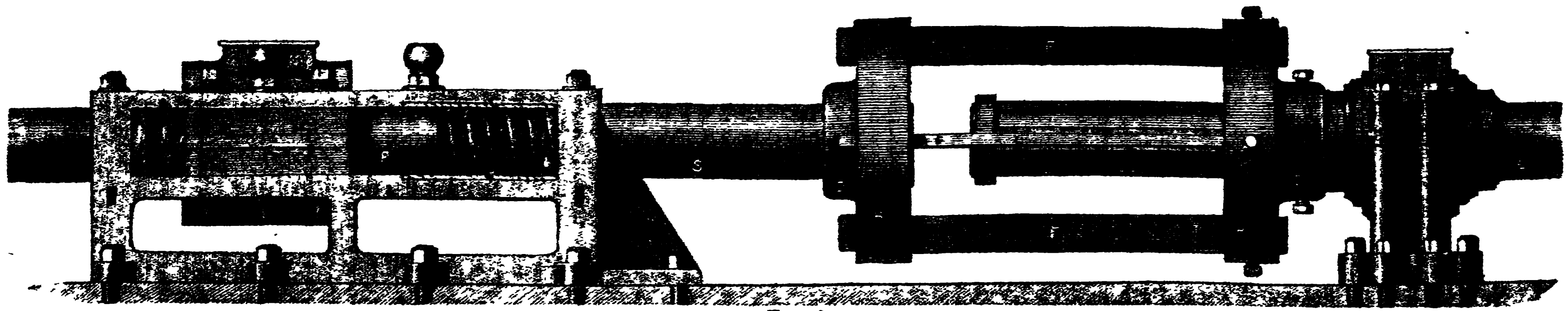


Fig. 2.

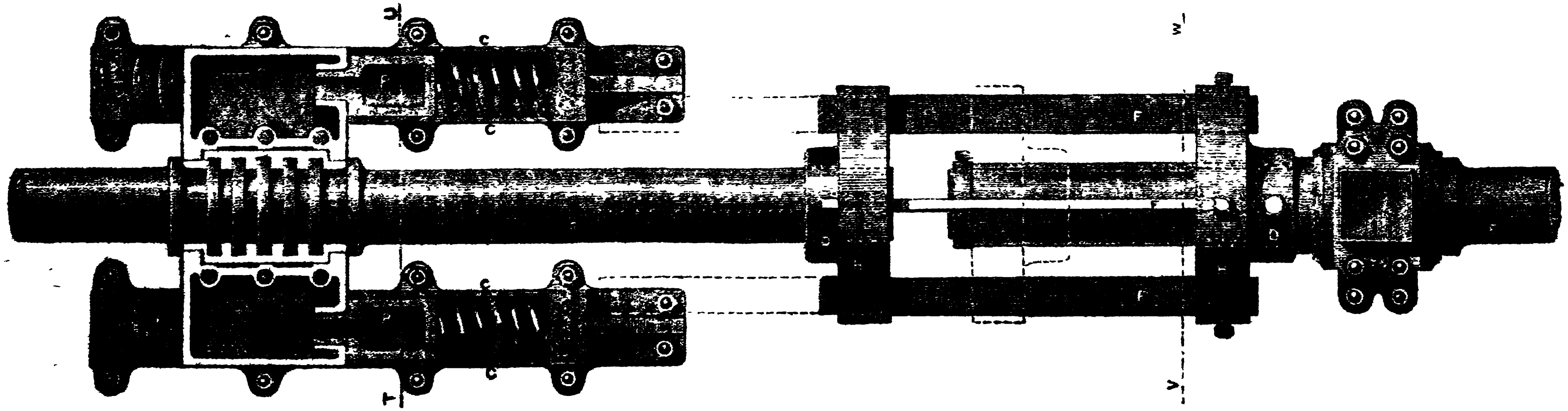
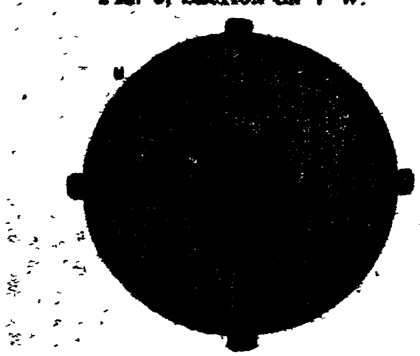
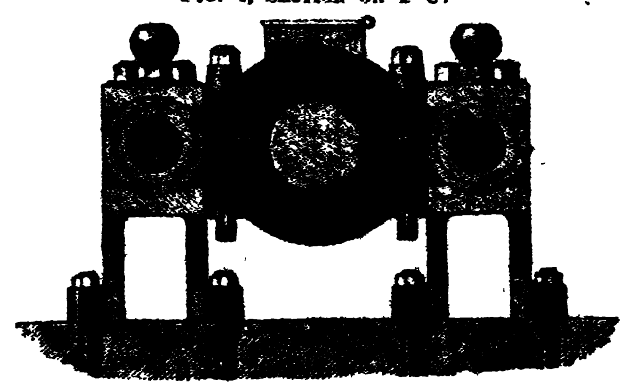


Fig. 3, Section on V W.



The Illustrations show the general arrangement of Mr. Pendred's invention. Fig. 1 is the side elevation, having the springs for the thrust blocks rendered visible by showing the cylinders enclosing them in section. Fig. 2 is the plan, which, also, has the spring cylinders in section, while the upper guide bars and upper half of the thrust block are removed to display the details more distinctly. Figs. 3 and 4 show cross sections. F F are the flexible blades placed in the discs D D, one of which can be moved up to the dotted lines; H H steel hoops which surround discs D D; E is the engine shaft; S, the screw shaft; C C are the thrust spring cylinders; B B is the thrust block and its lugs; P P are the plungers bearing against thrust springs. It is proposed by Mr. Pendred to supplement the washer recoil springs with small air cylinders and cup leather pistons. When the blade advances forwards, it draws the pistons readily with it, but on the engines being stopped, then the pistons recoil against the air as a cushion, and it can only escape slowly through a small hole in the end of each cylinder, so that all recoil shock is obviated.

Fig. 4, Section on T U.



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SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

President of Council:

SIR ANTONIO BRADY.

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Council Meetings Thursdays, July 16th (monthly special) and 30th. Executive meetings at same time.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts. F. W. CAMPIN, Sec.

Proceedings of the Institute.

AT the meeting of the Council (ordinary and special) held on 28th May, F. H. Varley, Esq., presiding, the minutes of the last meeting having been read and passed, the Secretary (Mr. F. W. Campin) stated that as this was the first meeting of the present Council, office-bearers of the Council ought now to be elected. The following elections then took place:—Sir Antonio Brady, President of the Council; Hume Williams, Esq., Barrister-at-Law, Vice-President of the Council for general meetings thereof; F. H. Varley, Esq., Vice-President of the Council for executive meetings. It was resolved that a sub-committee, consisting of Messrs. F. H. Varley, M. M. Harris, A. J. Murray, T Morgan, C. G. Carttar, and F. W. Campin (Secretary), together with the usual *ex officios*, be, and is hereby, appointed to draft a list of twelve members (exclusive of office-bearers as *ex officio* members) of the proposed executive of the Institute, and bring up same for approval and appointment by the Council.

At the meeting of the Council (ordinary and special) held on 11th June, C. Graham Carttar, Esq., in the chair, after the minutes of the last meeting had been passed, the Secretary brought up the report of the sub-committee giving a list of names suggested for members of the proposed executive committee or executive of the Institute, namely, Sir Antonio Brady, President of the Council of the Institute; the Treasurer, the two Vice-Presidents of the Council, the Secretary, the Auditor, and Capt. J. H. Selwyn; Messrs. W. H. Barlow, H. Bessemer, H. C. Coulthard, J. Faulding, D. J. McLauchlan, T. Morgan, A. J. Murray, F. Ransome, C. W. Siemens, and W. Yates.

It was resolved unanimously that any Vice President of the Institute, or other members of the Council, be entitled to attend the meetings of the executive committee or executive of the Institute, and take part in the proceedings thereof, but not to be summoned thereto.

The Secretary read letters from Sir Stafford Northcote, Chancellor of the Exchequer, and the Lord Chancellor, Lord Cairns, with reference to the reception of a deputation of the Institute on Patent Law Amendment (see p. 95).

At the meeting of the Council on 18th June, F. H. Varley, Esq., in the chair, the minutes of last meeting having been passed, the Secretary read a letter from the Premier, the Right Honorable Benjamin Disraeli, on the subject of the proposed deputation of the Institute to wait on him to state its views on the subject of the Patent Laws. After some discussion the meeting adjourned till Thursday, June 25th, at 4 o'clock p.m., to meet at the Office of the SCIENTIFIC AND LITERARY REVIEW.

The members' meeting on 11th June will be reported in our next.

Members recently admitted:—The Hon. Wyndham E. C. Stanhope, Messrs. A. Brown, M. T. Landau, Aris, Louisson, C. W. Flood, F. J. Bird, W. Holyoake, P. H. Egerton, J. B. Hamilton, E. Roberts, C. L. Light, C.E., W. W. Box, W. L. Mitchell, Hartley, Topham, W. Wilson, G. Gale Row.

Monthly Notices.

Macmillan's edition of White's "Selborne" is to be edited, as regards Natural History, by Mr. Frank Buckland, and Lord Selborne is to contribute a chapter on the British antiquities lately discovered there.

Rapid Decay of Iron.—The *Athenæum* states that Mr. E. W. Binney, at a meeting of the Manchester Literary and Philosophical Society, exhibited some portions of the roof of the railway station at Salford, which, after being in place four years, was so much corroded that it had to be taken down. The sulphuric acid and soot, from the combustion of coal used in the locomotives, has evidently been the cause of this. As Mr. Binney remarked, it is most desirable, seeing the extent to which iron is used in construction, that the public should be made acquainted with all the circumstances under which decomposition is produced in this metal. It is but recently that an iron ship has sunk at sea, through the action of sugar upon her iron plates, producing rapid decomposition.

The Chinese and Japanese patina bronzes have been examined by M. Henri Morin, of the Paris Conservatory, who finds that lead enters largely into the composition of those bronzes. In some specimens as much as 20 per cent. was found. These bronzes, which contained 80 parts of copper, 10 parts of lead, 4 parts of tin, and 2 parts of zinc, were found to be of close and beautiful grain; and, when heated in a muffle, it quickly takes the dark patina, which has been hitherto thought to be a varnish.

University of Edinburgh Practical Schools.—A meeting will shortly be held in London to raise subscriptions for the extension of the practical schools of the University of Edinburgh. Already £60,000 has been subscribed in Edinburgh for the purpose, but £40,000 more is required. An influential Committee has been appointed in London with Dr. Dyce Duckworth and Dr. George Birdwood as Honorary Secretaries, and the arrangements for the public meeting are being rapidly matured.

The Sanitary Record, a journal of public health, a new weekly paper to be published by Messrs. Smith, Elder, and Co., is to appear soon. It will deal with the hygiene of houses, schools, nurseries, hospitals, workshops, mines, &c. It will be under the editorship of Mr. Ernest Hart.

The Social Science Congress in Glasgow has been definitely fixed for the 30th September; Lord Moncrieff to be President of the Jurisprudence Section, Lords Ardmillan and Gifford assisting him. Mr. Frederick Hill is to preside over that on the Repression of Crime, now a question for consideration.

A College for Science and Literature is proposed to be established, with a view to providing for the special requirements of the West of England and South Wales. Its principal purpose will be to give advanced instruction to those who are anxious to continue their studies after the usual school age. Two Oxford Colleges, Balliol and New, have resolved to contribute the weight of their influence and name, and subscribe £300 a year each for five years, merely stipulating that the claims of liberal education of all kinds be duly considered, and that they themselves share in the management. Bristol has been indicated as the site for such a college, and the authorities of the local museum, and of the Bristol library, which has lately been united with it, have expressed a willingness to associate the proposed college with their institution. Another local source of strength is the promised co-operation of the British Medical School, the faculty of which, having formed the design of erecting new buildings, are ready to unite in a joint undertaking.

A Conversazione of the Anthropological Institute is arranged for Wednesday evening, July 1, at the Bethnal Green Museum, when an address will be delivered by Col. Lane Fox, illustrative of the loan collection of weapons he has liberally placed there. The museum will be lighted up, and ladies will on this occasion be invited.

Mr. G. Smith's Travels in Assyria and operations at the mounds of Kouyunjik are to be brought before the Society of Biblical Archæology, on the 7th of July, at their rooms in Conduit-street.

University Library, Cambridge, will be closed from June 24 to July 7, both days included.

Antonio Maschio, the Dante commentator and gondolier, whose critical labours have been published under the auspices of Prof. Alberto Errera, has lately given three lectures on the "Divina Comedia," at the Teatro delle Loggie of Florence, dressed in the characteristic costume of his profession.—*Athenæum.*

Jeremiah Horrox and the Transit of Venus.—The first observer of this transit, it is now thought, should have a memorial in Westminster Abbey.

Temperature of the Water in the Atlantic.—The Government Scientific Expedition has, amongst other things, proved that on the western side of the Atlantic, at all the stations south of the Bermuda and Azores line, the bottom water is colder than that on the east side, which shows that the Antartic cold current enters the North Atlantic, runs to the north-westward through the channels between St. Paul's rocks and the Brazilian coast and gradually expends itself as it circles round to the north-eastwards, in the same manner as the warm equatorial current does on the surface, considering that current as including the Gulf Stream, which it undoubtedly helps to produce. This cold current entering the North Atlantic is found between 1,700 fathoms and the bottom, a total thickness of 700 fathoms. The heat-giving properties of the equatorial and north-east trade current, carrying as they do a continuous body of warmed water towards the Caribbean Sea, can be traced by the rise in temperature of the whole body of water at Sombrero, and afterwards at all the stations in the North Atlantic, but most readily so by the widening of the isotherms about 62 degrees, between America and Azores. Thus is formed an immense reservoir of warmed water, 1,000 feet thick, and at least two millions of square miles in extent. This change of temperature or disturbance is greater, and nearer the surface on the western side of the Atlantic, the nearest point to the source of the current, than at the eastern side, where it slowly and gradually expends itself. The most remarkable fall of temperature due to depth has been found at a station 180 miles south of Cape de Verde Islands, at the south edge of the trade wind, the temperature at 50 fathoms being 51·2 degrees, when the surface was 78 degrees, a fall of 24 degrees.

Prof. G. Forbes, who, as deputy chief of the Sandwich Islands party, is to take charge of the observations at Owhyhee, is now on his voyage. The principal Egyptian station will be at Cairo, and there is a probability that the transit will also be observed at, or near the site of, ancient Thebes.

The French Association for the Advancement of the Sciences is to hold its third meeting this year at Lille, the session commencing on the 20th, and closing on the 27th, of August.

Ancient Egyptian Blue.—The Egyptians appear to have been acquainted with the preparation of three distinct kinds of blue pigment, prepared from mixtures of sand, soda, and lime, with oxide of copper. One of these fine colours has been lately examined by M. Henri de Fontenay, who contributes a paper on the subject to the June number of the *Annales de Chimie*. The author publishes not only analyses of ancient specimens, but recipes for their imitation. A mixture of 70 parts of white sand, 25 of chalk, 15 of oxide of copper, and 6 of dry carbonate of soda, yielded, when fritted together, a blue material said to be equal in colour, texture, and durability to the ancient examples.

The New Shakspere Society.—The *Academy* says that the New Shakspere Society at the present time numbers 401 members.

Proceedings of Societies.

ROYAL SOCIETY.

May 21st.—W. Spottiswoode, Treasurer and V.P., in the chair.—The following papers were read: "On the Structure and Development of *Peripatus Capensis*," by Mr. H. N. Moseley,—"The Uniform Wave of Oscillation: an Analysis," by Mr. J. Imray,—"Some further Experiments on the Transmission of Sound," by Dr. Tyndall,—"On some recent Experiments with a Fireman's Respirator," by Dr. Tyndall,—and "On Combinations of Colour by Means of Polarised Light," by Mr. W. Spottiswoode.

June 4th.—J. D. Hooker, President, in the chair.—The annual meeting, for election of Fellows, was held. The following were elected:—I. L. Bell, W. T. Blanford, H. B. Brady, T. L. Brunton, M.D., Prof. W. K. Clifford, A. W. Franks, Prof. O. Henrici, Ph.D., P. G. Hewett, J. E. Howard, Sir H. S. Maine, LL.D., E. J. Mills, Rev. S. J. Perry, H. W. Rumsey, M.D., A. R. C. Selwyn, and Major C. W. Wilson.

June 11th.—The President in the chair.—The following papers were read:—"Preliminary Note on the Absorption of great Thicknesses of Metallic and Metalloidal Vapours," by Mr. J. N. Lockyer,—"Note on the Absorption Spectra of Potassium and Sodium at Low Temperatures," by Prof. Roscoe and Mr. A. Schuster;—"Note on the alleged Existence of Remains of a Lemming in Cave-Deposits of England," by Prof. Owen;—"On the alleged Expansion in Volume of various Substances in passing by Refrigeration from the State of Liquid Fusion to that of Solidification," by Mr. R. Mallet, and "Note on the Excitation of the Surface of the Cerebral Hemispheres by Induced Currents," by Dr. B. Sanderson.

ANTHROPOLOGICAL INSTITUTE.

May 12th.—Prof. Busk, President, in the chair.—Messrs. J. E. Spratt and W. G. Thorpe were elected Members. Messrs. Garrard and Co. exhibited a collection of gold objects from Ashanti. Mr. F. Galton gave some results of school statistics which he had obtained from Marlborough and Liverpool Colleges. A paper, also by Mr. Galton, was read, "On the excess of Female Population in the West Indies." The author had made use of, and embodied the results in the paper, a mass of statistics that had been furnished by the Colonial Office. A paper, by the Rev. H. W. Watson, was read, "On the Probability of the Extinction of Families," with prefatory remarks, by Mr. F. Galton. The author remarked that it is not only the families of eminent men, or of the aristocracy, who tend to perish, but also those of municipal notabilities and others whose names were once common and familiar, but have since become scarce, or have wholly disappeared. The conclusion drawn was, that an element of degradation must be inseparably connected with one of amelioration, and that our race is necessarily maintained chiefly through the "proletariat." The problem, which was one purely for the mathematician, was to ascertain what proportion of specified families will necessarily become extinct after a few generations. It would be easy then to measure the diminution of fertility by the frequency of extinction. Major Godwin-Austen contributed a paper "On the Rude Stone Monuments of the Nagas."

May 26th.—Prof. Busk in the chair.—Mr. G. M. Atkinson was elected a Member.—The paper read was by Mr. Hyde Clarke, "On Researches in Prehistoric and Protohistoric Comparative Philology, Mythology, and Archæology, in connexion with the Origin of Culture in America, and its Propagation by the Sumerian or Accad Families." It dealt with the relations of language to culture, as cultural philology. A sketch was given of the succession or chronology of languages, the earliest places being assigned to the pygmean and cannibal races, and the distribution of the various classes in America, Africa, and India, being dealt with. To one class were assigned the Darib, Whydah, and Aino, languages of Honduras were compared to West Africa, and the Khond to the Wolof. The Agaw languages were treated as having been introduced into South America as Guarani, Omagua, &c., and displaced by the more civilised Sumerian in Peru. Proceeding to consider the origin of the early languages, the laws of formation of animal and weapon names, and of negative words, were illustrated. With regard to the epoch of the monument-building peoples, affinities of language were shown among these; and Mr. Clark proposed to employ Sumerian for the class, and Accad for the single language. Starting, probably, from High Asia, one branch passed as Accad to Babylonia, and another to India and Indo-China, including Pegu and Cambodia (Kemer). Thence traversing the Pacific by Easter Island, and following the Agaw, a migration passed into America, founding the Aymara domination in Peru, and that of the Maya in Yucatan. A second wave probably supplied the Georgian and Etruscan in the West, the Siamese, &c., in Indo-China, the Quichua (Clwai?) in Peru, and the Aztek in Mexico. Comparisons of grammar were given of the newly-deciphered Accad (cuneiform) with the Quicha and the Georgian. The author considered that tradition indicated an ancient knowledge in Western Asia, afterwards obscured, of the intercourse with America and Australia.—Mr. P. Harrison, Col. L. Fox, Consul Hutchinson, Dr. Leitner, and others, took part in the discussion.

June 9th.—Prof. Busk, President, in the chair.—Dr. W. S. Church was elected a member. Sir J. Lubbock, Bart., read a paper "On the Discovery of Stone Implements in Egypt." The author began with a sketch of the writings and opinions of M. Arcelin and Dr. Hamy, who maintained that the flint implements found along the valley of the Nile, including a hatchet of the St. Acheul type at Deir el-Bahari, indicated the existence formerly of a true stone age there as in Western Europe. M. Mortillet and Dr. Broca concurred in that view. On the other hand, Dr. P. Bey, and especially Dr. Lepsius, had expressed the opinion that most of the objects described, such as the flint flakes, were naturally produced. M. Chabas also took the same view as Dr. Lepsius, and denied the existence of any evidence of a stone age either in Egypt or elsewhere. On the occasion of a late visit to Egypt with the object of getting conclusive personal evidence on the question, the author found worked flints at various spots along the Nile valley, especially in the valley of the tombs of the Kings at Thebes and at Abydos, and after carefully weighing the facts and arguments brought forward by MM. Lepsius and Chabas, he was disposed to agree with MM. Arcelin and Hamy in considering that these flint implements really belonged to the stone age, and were ante-Pharaonic. Sir John exhibited a full series of the Egyptian flint implements found by himself during his visit, and the paper concluded with a minute description of each specimen. Prof. Owen read a paper "On the Ethnology of Egypt." Since the observations recorded in 1861 by Pruner-Bey, on the race-characters of the ancient Egyptians, mainly based on the characters of skulls, evidences in the author's opinion of a more instructive kind have been discovered, chiefly by Mariette-Bey. They consist of portrait sculptures mostly, statues found in tombs, accompanied by hieroglyphic inscriptions, revealing the name, condition and date of decease. A study of those works led to the conclusion that three distinct types were indicated; first, the Primal Egyptian type, with no trace either of negro or Arab; secondly, the type of the

conquering shepherd kings, or Syro-Arabians, which is exemplified in the Assyrian sculptures; thirdly, the Nubian-Egyptian. In conclusion, the Professor drew a graphic picture of the high state of civilisation attained by the ancient Egyptian race, whose exquisite works, done six thousand years ago, were amply illustrated by a series of photographs, maps, and diagrams. Mr. E. Schuyler communicated a paper "On the Batchas of Central Asia."

GEOLOGICAL SOCIETY.

MAY 13TH.—J. Evans, Esq., President, in the chair.—Messrs. A. Browning and L. Rhys were elected fellows; and Dr. T. C. Winkler, of Haarlem, and Dr. J. S. Newberry, of Washington, Foreign Correspondents of the Society. The following communications were read: "Note on some of the Generic Modifications of the Plesiosaurian Pectoral Girdle," and "*Murænosaurus Leedsii* (Seeley), a Plesiosaurian from the Oxford Clay," Part I., by Mr. H. G. Seeley,—and "On the Remains of Labyrinthodonts from the Keuper Sandstone of Warwick, preserved in the Warwick Museum," by Mr. L. C. Miall.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

MAY 13TH.—Annual General Meeting.—J. R. Planche, Esq., V.P., in the chair.—The Balance Sheet having been read and approved, the Meeting proceeded to the ballot of Officers and Council for the year, when the following list was adopted:—President, K. D. Hodgson, M.P., Vice-Presidents, The Earl of Effingham, Sir J. G. Wilkinson, H. Syer Cuming, J. Evans, G. Godwin, R. N. Phillips, J. R. Planché, Rev. Prebendary Scarth, Rev. W. S. Simpson, and T. Wright; Treasurer, T. Morgan; Secretaries, E Levien and E. Roberts; Secretary for Foreign Correspondence, T. Wright; Palæographer, W. De Grey Birch; Curator and Librarian, G. R. Wright; Draughtsman, G. F. Teniswood; Council, G. Ade, T. Blashill, W. Bragge, C. Brent, G. E. Cookayne, W. H. Cope, R H. Fisher, J. H. Foley, A. Goldsmid, J. W. Grover, H W. Henfrey, Rev. S. M. Mayhew, C. G. Adams, J. S. Phené, J. W. Previté, and S. I. Tucker; Auditors, E. P. L. Brock and F. A. Waite.

MATHEMATICAL SOCIETY.

MAY 14TH.—Dr Hirst, President, in the chair.—Mr. L. Hammond was elected a Member; the Rev. A. J. Stevens and Mr. W. Ritchie were proposed for election.—The papers read were, "On the Correlation of two Planes," by the President.—"The Contact of Quadrics with other Surfaces," by Mr. W. Spottiswoode.—A paper, by Mr. L. H. Rohrs, "On a Rotating Sphere filled with Viscous Fluid," was taken as read.—Dr. Hirst, Mr Spottiswoode, and Prof. Clifford took part in the discussions on the papers.

June 11th.—Dr. Hirst, President, in the chair.—The Rev. A. J. Stevens and Mr. W. Ritchie were elected members; Dr. J. Casey was proposed for election, and Mr. G. S. Carr was admitted into the society.—The President, before vacating the chair, informed the meeting that Lord Rayleigh (a member of the council of the society) had expressed his intention, in a letter, of presenting to the society the sum of £1,000, to be invested, and the interest applied to assist in the publication of the proceedings, and also in the purchase of Mathematical periodicals.—Prof. Cayley having taken the chair, the following papers were read: "On the parabola of Developables, and of Curves of Double Curvature," by Mr. S. Roberts; "Note on the Numerical Calculation of the Roots of Fluctuating Functions," by Lord Rayleigh; "On a [illegible] Relation between the Distances of Two Perpendicular Arcs of an Ellipse of Eccentricity $\frac{1}{\sqrt{2}}$, and that of two Corresponding Arcs of a Hyperbola of [illegible]," by Mr. J. Griffiths; "Stability of a Dynamical System, with Two Independent Motions;" and "On Rocking Stones" and "Small Oscillations to any Degree of Approximation," by Mr. E. J. Routh.

ZOOLOGICAL SOCIETY.

MAY 19TH.—Dr. E. Hamilton, V.P., in the chair.—Mr. Sclater exhibited a skin of the new Japanese stork (*Ciconia Boyciana*), and read an extract from a letter from M. Taczanowski, relating to its occurrence in the Amoor territory. Letters were read from Dr. W. Peters, relating to the locality of *Periodogaster Grayi*, and from Doctor Hector containing a correction to his article on Cnemiornis, published in the Society's proceedings. Prof Newton exhibited and remarked on two original letters, the property of Dr. J B. Wilmot, written from Mauritius in 1628, and referring to the Dodo. Letters and communications were read from Mr G. E. Dobson, on some experiments made on the respiration of certain species of Indian freshwater fishes,—from Mr W. H. Hudson, on the habits of the burrowing owl (*Pholeoptynx cunicularia*) of the pampas of Buenos Ayres,—from Mr C W. M'Intosh, on "Contributions to our knowledge of the British Annelids;" and another containing the portion of an account of the Annelids collected during to *Porcupine* Expeditions of 1869 and 1870,—from Dr. J E. Gray, on the species of feline animals (Felidæ),—from Dr. Gray, on a new species of cat, from Sarawak, proposed to be called *Felis Badia*,—and from M. L. Taczanowski, entitled, "Déscription d'une Nouvelle Espèce de Mustela du Pérou Central."

June 2nd.—Arthur Grote, Esq., F.Z.S., in the chair.—The Secretary read a report on the additions that had been made to the Society's menagerie during the month of May, 1874, amongst which were specially noticed a blue-faced green amazon parrot (*Chrysotis bouqueti*), a young male koodoo antelope (*Tragelaphus strepsiceros*), and a racoon-like dog (*Nyctereutes procyonides*), acquired by purchase; two Pacific whimbrels (*Numenius femoralis?*) from Quiros Island, Pacific, presented by the Rev. S. J. Whitmee, C.M.Z.S.; a Beisa antelope (*Oryx beisa*), presented by Admiral Cumming, and a Guilding's amazon (*Chrysotis guildingi*), transmitted by Mr. G. H. Hawtayne, from St. Vincent, W.I. A letter was read from Mr. T. D. Forsyth containing an account of some of the animals met with in the vicinity of Kashgar. An extract was read from a letter received from Mr. E. P. Ramsay, C.M.Z.S., relating to a living cassowary (*Casuarius australis*), which he was proposing to send to the society's collection. Professor Owen, F.R.S., read the fifth part of his series of memoirs on the "Osteology of the Marsupialia." This portion contained a general account of the osseous structure of the kangaroos. Lt. Col. H. Irby, F.Z.S., exhibited specimens of apparently a new species of raven, which he had lately obtained in the vicinity of Tangier, Morocco, and which he was intending to describe under the name of *Corvus tingitanus*. A communication was read from the Rev. O. P. Cambridge, C.M Z.S., on some new species of the Arachnidean family of *Drassides*, from various localities. A communication was read from Dr E. Grube, containing descriptions of new annulats, collected by Mr. E. W. H. Holdsworth on the coasts of Ceylon. A communication was read from Mr. W. Nation on the habits of *Spermophila simplex*, as observed in the vicinity of Lima. A communication was read from Mr. A. G. Butler containing a list of the butterflies of Costa Rica, with descriptions of new species. The next meeting for scientific business (concluding the present session), was appointed to be held at the society's house, in Hanover-square, on the 16th of June, 1874, at half-past eight o'clock, p.m., to receive the following communications:—1.—Dr. J. Murie.—On the nature of the [illegible] [illegible] by the hornbills. 2.—Mr. W. Saville Kent.—A further communication upon certain gigantic cephalopods recently encountered off the coast of Newfoundland. 3.—Mr. A. H. Garrod, F.Z.S.—On the "Showing off" of the Australian bustard (*Eupodotis australis*). [Received 23rd May, 1874.]

CHEMICAL SOCIETY.

MAY 21ST.—Prof. Odling, President, in the chair.—Dr. Corfield delivered his lecture "On the Sewage Question from a Chemical Point of View." The lecturer, after remarking that he was going to consider the question of the value of chemical evidence on the sanitary view of the subject, compared the various systems for treating sewage, all of which might be reduced to two classes, the first, that of conservancy, where more or less of the solid matter was retained in the neighbourhood of habitations; and the other, where the whole of the excretal matter was removed along with the foul water by means of sewers. He emphatically condemned the former as poisoning the wells in the neighbourhood and liable to give rise to disease, for it was a fact that the smallness of the death-rate at any large town was proportional to the efficiency of the means used for the removal of the sewage. He subsequently discussed the various methods of rendering sewage innocuous, showing that the only one of any value for this purpose was that of intermittent surface irrigation.

June 4th.—Prof. Odling, President, in the chair. The following papers were read:—"Dendritic Spots in Paper," by Mr. H. Adrian. These he finds to consist of sulphide of copper formed from particles of gun-metal derived from the machinery employed in manufacturing the paper, and are far more usually found in common papers than in the better classes. "The Acidity of Normal Urine," by Mr. J. Resch. "On a simple Method of Estimating Urea in Urine," by Dr. Russell and Mr. West. The apparatus employed for this purpose was exhibited, and a practical illustration given by Mr. West. "On Ipomæic Acid," by Messrs G. Neison and J. Bayne. This acid prepared by the action of nitric acid on jalapin, the authors find to be identical with sebacic acid. "On Certain Compounds of Albumen with the Acids," by Mr. O. S. Johnson. "On Sulphite of Acetyl," and "On a new Method of Preparing Toluene," both by Dr D. Tommasi. And "Note on New Zealand Kauri Gum," by Mr M. M. P. Muir.

METEOROLOGICAL SOCIETY.

MAY 20TH.—Dr. R. J. Mann, President, in the chair.—Mr. D. G. Briggs was elected a Fellow, and the names of fourteen candidates for admission were announced. A Report was read from the council on the observation of natural periodical phenomena. The following papers were read:—"Some Remarks on the Estimation of Wind Force, and the Relation between Pressure and Velocity," by Mr. C. O. F. Cator, in which he first expressed a strong opinion on the impossibility of estimating the force of the wind with any degree of accuracy; but thought that for any useful purpose it must be obtained from instrumental observation. As to comparison of pressure and velocity, he thought that simultaneous records from the instruments and limited scales now in use are quite inconvertible; but that such a result might be practicable if an extended scale were applied to a pressure anemometer. He then referred to the different notations for describing the wind, and condemned Beaufort's (0-12) as eminently unsatisfactory, both on account of the means by which the numbers were arrived at, and especially because of the difference of standard for the lower and higher numbers. He then proceeded to account for the difference of force, as estimated, at any station from different directions, although the velocity as shown by

Robinson's cups might be the same—partly by the position of the observer not being identical with that of the cups, and partly from the surrounding objects. He then suggested a new scale, and that, whether pressure or velocity were the basis, it should increase in arithmetical progression; and concluded by expressing his preference for the former.—"On the Weather of Thirteen Winters," by Mr R. Strachan.—"On a New Deep-Sea and Recording Thermometer," by Messrs H. Negretti and J. W. Zambra.—"On a New Mercurial Minimum and Maximum Thermometer," by Mr S. G Denton.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

At the meeting on the 2nd June—S. Birch, LL.D F.S.A., president, in the chair—the following candidates were duly elected members of the Society: Mrs. Crosbie, Ardfert; Rev. J. M Dalton, M A, Marlboro' House; Robert Darbyshire, B A., F.S.A., F.G S.; Charles I. Hemans, Miss Margaret Henderson; John Gurney, Norwich; Mrs. Lennox, Sutton; Mrs C D. Marston; H. S. Mitchell; John Muir, LL.D., D C L., Ph D., Edinburgh; J. Linton Palmer, M.D., F.S A; C D. Purdon, Belfast; Col J. Roxburgh. The following Papers were then read:—1. "On the Phœnician Inscription "Melitensis Quinta." By Prof W Wright, LL D—This paper reviewed the earlier readings of the inscription by the Duc de Luynes, Quatremère, Ewald, and Blau; and gave a revised text and translation, based on an examination of the stone itself. It was accompanied by a fac-simile of the stone described. 2. "On an Egyptian Calendar of Astronomical Observations of the XXth Dynasty." By P. Le Page Renouf, F R S L.—This paper was a collection and a correction of the famous Calendar of Star Culminations, which had been published by MM. Champollion and Biot, the latter savant having, however, been misled by believing the papyrus to be astrological only. The text was accompanied by a full exegesis and a diagram of astral positions. 3 "On the Cylindrical Altar of Nectarhebes at Turin" By Joseph Bonomi ([illegible] two plates).—This interesting monument, which, although noticed by Orcurti, is now published for the first time, is a large cylindrical altar of black granite, finely wrought, and covered with sixty-eight vertical lines of hieroglyphics and four vignettes, representing the Pharoah Nectarhebes of the XXXth Dynasty making offerings, and uttering adorations to the various deities of the four cardinal points. 4. "Translation of the Hieroglyphic Inscription upon the Granite Altar at Turin" By Samuel Birch, LL.D, F.S.A., President.—In this paper, the learned Egyptologist gave a literal translation of the hieroglyphic text, which showed it to be a series of Adorations to the Deities of the South, North, West, and East, mentioning the particular cities in which they were worshipped, thus adding some fresh names to the geographical lists of ancient Egypt under the Persian Dynasty. 5 "Assyrian Notes." By H Fox Talbot, F R S.—(1). "The use of Papyrus among the Ancient Arcadians."—In his recent investigations as to the original meanings of some of the Assyrian roots, Mr. Fox Talbot found that the terms Nasabu Shakani, "the stem of a reed," and Nigris, "a volume," and "writings upon vegetable skin," occur among the Assyrian inscriptions published by the British, thus attesting the accuracy of the statement of Pliny, that the Papyrus was so used by the Babylonians, a fact which, till Mr. Sayce first called attention to it, had been disputed. (2). "Assyrian Books." In this paper, the following sentences were adduced to show that the Assyrian literature was not confined solely to inscriptions upon tablets of baked clay: "In the night-time bind around the sick man's head a sentence taken from a good book" (for a charm); and "care not to save the newly-written books," &c. (3). "On the amount of accuracy now sometimes attainable in Assyrian Translation."—This paper was a retrospective summary of what had been done in Assyriology for the last twenty years, showing that the very discrepancies of different translators was an evidence of their general agreement, in proof of which Mr. Talbot gave a translation in parallel columns of an Assyrian Hymn, translated in English by himself, and in French by M. F. Lenormant, which differed only in the most trivial points of idiom.

LINNEAN SOCIETY.

June 4th.—G. J. Allman, M.D., President, in the chair.—The President exhibited a number of living specimens of firefly (*Luciola Italica*) recently taken by himself in the neighbourhood of Turin, calling attention to the remarkable synchronous emission of flashes of light by numerous individuals, and pointing out that the phosphorescence is a phenomenon not of darkness merely, but of twilight or night. The following papers were read:—"Contributions to the Botany of the *Challenger* Expedition," presented by Dr. J. D. Hooker, C B.; No. XII*a*, "*Challenger* Lichens (Cape de Verdes)," by Dr. J. Stirton, No. XVII*a*, "Letter from Mr. H. N. Moseley to Dr. Hooker, dated Cape Otway, Australia, March 16, 1874, on the Botany of Kerguelen's Land, Marion, and Heard Islands. No. XVIII., "List of hitherto unrecorded Species from Kerguelen's Land, Marion, and Heard Islands, with a Note on *Lyallia Kerguelensis*, Hook. f.," by Prof. Oliver; "Synopsis of the Mosses of the Island of St. Paul," by W Mitten (Appendix to Dr. Hooker's paper "On St. Paul's Island Plants"), "On the Restiaceæ of Thunberg's Herbarium," by Dr. M. T. Masters; and "On Napoleona Omphalocarpum, and Asteranthos," by Mr. J. Miers.

MICROSCOPICAL SOCIETY.

June 3rd—C. Brooke, Esq., President, in the chair. A number of donations to the Society were announced, and six new Fellows were elected. Mr. Slack called attention to a slide exhibited in the room, as being a remarkable specimen of Herr Muller's technical skill in diatom mounting. The slide had photographed upon it, in an extremely beautiful and perfect manner, eighty spaces with the names of diatoms below each, and a diatom of corresponding species was mounted in every space. Mr Slack also said that he had received specimens of silica solutions in the milky condition described by Mr. Read at the last meeting, but was himself unable to detect any particles suspended in it, though some had been detected by Dr. Anthony. Mr. C. Stewart described and figured on the board the peculiar position of the touch corpuscles in the skin of the hand; and he also exhibited and described a section of an ascidian, and explained the method of preparation. The President stated that the Society's rooms and library would be closed during the month of August.

CONVERSAZIONE BY THE PRESIDENT OF THE INSTITUTION OF CIVIL ENGINEERS.

The Conversazione given by the President of the Institution of Civil Engineers and Mrs Harrison on Tuesday, May 19th, proved an eminently successful gathering, for the portion of the International Exhibition in which it took place was crowded with a brilliant assemblage of ladies and gentlemen, mostly, as may be expected, connected with the profession. Part of the picture gallery was open, and in this the President received his guests. The machinery department of the Exhibition was in full action, and besides those forming exhibits at the Exhibition there were models lent for the evening, some of them proving of a highly interesting and instructive character. Amongst these were self-acting brakes and automatic couplings for railway carriages, which had a fair share of attention paid to them. We noticed also Mr. Handyside's model of locomotive to overcome steep gradients, which, we presume, is in illustration of the small work published by him which we lately reviewed. We also noticed the patent locks of Mr. J. Morrison, which, by the way, are among the exhibits in the Exhibition. A model of Mr. Pendred's screw propeller shafts and thrust blocks, a paper on which subject was read by him at the last meeting of the Inventors' Institute: a model of Dr. Siemen's cable ship *Faraday* were also exhibited. There were also a number of other interesting models, and amongst them we noticed the model of Messrs. Varley and Furness' power coupling for heavy machinery, which is to be used for preventing sudden strains and shocks either upon setting machinery in motion or arresting machinery when in motion. A model of Mr. Whitehouse's electrical recorder for tram-cars and omnibuses attracted much attention.

YATES'S SAFETY LAMP.

Mr. Yates informs us that the City Gas Examiner has tested his safety lamp in its different forms, comparing same with the Davy and Clanny lamps. He gives the results in a comparative table, which we regret to be unable to present to our readers. Each lamp was trimmed so as to give its best light.

We extract the concluding portion of his report, which is as follows:—

The "all-round" Yates seems to me at present the best lamp, which, I think, is due to the much larger space round the wick, permitting a more free access for the products of combustion.

The lamp with a chimney has a tendency to return the products of combustion down into the flame, and so causes it to smoke and dirty the glass sooner.

In round numbers, the Yates lamp gives, for equal consumption of oil, twice the light of the Clanny, and four times that of the Davy.

(Signed),
Charles Heisch, F.C.S.
Professor of Chemistry in the Medical College of the Middlesex Hospital, and Superintending Gas Examiner to the Corporation of the City of London.

Mr. Yates notes with regard to the above that Yates's "chimney" lamp is No. 1 pattern with the addition of an inner funnel or chimney, and his "all round" is No. 3 pattern lamp as described in his pamphlet, and is made with a peculiarly shaped glass which intensifies the light.

SIMPLIFICATION OF ALGEBRAIC PROCESSES.

With reference to the paper on the "Division of Abgebraic Quantities by the Method of Detached Coefficients," by Mr. Edward David Hearn, published in last month's Scientific and Literary Review, and describing an extension of Horner's rule, so as to include divisors, the leading term of which is other than unity, a very useful suggestion is made by the Rev. Professor Galbraith, of Trinity College, Dublin, whose name is widely known in connection with the excellent scientific manuals of which he was joint author—Galbraith and Haughton's Manuals. He writes:—"I have just read your paper, and worked the examples you give, and a few others. I think your rule very valuable, and will teach it in future. I have only one remark to make, trifling, but yet I have found it very convenient in working, to put negative signs over the figure, thus: [illegible], &c. It makes the work look much neater, as you can write the figures closer." In this case the positive signs would never,

of course, be written; all figures without the negative sign over them being regarded as positive. The advantage of Professor Galbraith's suggestion will at once be seen upon comparing any given example written in the two forms.

APPLICATIONS FOR LETTERS PATENT.

(Continued from page 94.)

On April 1st.—1133 to 1142.—G. Edwards. Continuous brakes for railway trains.—G. W. Dolman and B. Benjamin. Apparatus for indicating the number of passengers using tramway cars or other vehicles, or passing into or from public buildings or other places.—F. W. Webb. Injectors.—Robert Rankin. Governor for steam engines.—E. Lee. Process for producing ornamental designs, letters, patterns, or figures on glass, metal, china, wood, and other such like surfaces, for decorative and other purposes. W. T. Culmer. Manufacture of varnish, paint, or other similar brushes.—G. Montezore. Advertisements by railway tickets and other public utility and pleasure services.—E. Hoskins and C. Harvey. Manufacture of taper and parallel tubes, single or compound.—A. Swingle, F. A. Huntington, and W. J. Miller. Breech-loading magazine fire-arms. (Complete specification).—N. Clayton and J. Shuttleworth. Portable engines.

On April 2nd.—1143 to 1161.—J. H. Carruthers and D. Rankine. Tramway carriages.—J. S. A. Ménier. War and commercial aerostatic hot air balloons.—J. Claghorn and T. G. Paterson. Treatment and preparation of asbestos, and making various fabrics and articles therefrom.—C. Topham. Machines for washing and peeling potatoes, and peeling, reducing, or pulping other roots.—A. L. Sparkes and C. Marsh. Instrument for ascertaining and indicating any extraordinary temperature in buildings and apartments of every kind.—W. Howgate. Finishing fabrics and apparatus employed therein.—F. E. B. Beaumont. Rock or stone drilling or boring machinery.—W. M. Halbert. Colour printing of books and newspapers.—C. Herreux. Tanning and apparatus used therefor.—W. Crookes. Treatment of waste or refuse animal nitrogeneous matters for the purpose of producing fertilising substances or artificial manures.—S. Dear. Drawing and spinning machinery for flax, hemp, jute, wool, or other fibrous material.—W. T. Bury and A. Muir. Apparatus for making true the rolls of plate and sheet mills.—J. T. Martin. Manufacture of corks and apparatus employed therefor.—R. R. Cox. Chimney caps or terminals and wind guards.—R. W. P. Birch. Apparatus for flushing sewers, drains, reservoirs, and other waterways, applicable also for discharging measured quantities of water or other fluid.—O. Callis. Railway fog signal apparatus.—W. M. Bullivant. Telegraph cables.—A. M. Clark. Culinary apparatus (com.)—J. Liddell. Brick-making machines.

On April 4th.—1162 to 1193.—G. W. Heaton. Boring tunnels, and machinery or apparatus to be employed therein.—W. H. J. Grout. Bicycles and wheels, such wheels being applicable to bicycles, carriages, and other vehicles.—J. Walker. Carriages or vehicles for the conveyance of goods and passengers on railways, and for the easy and safe transit of such carriages from any one guage of railway to another and different guage without points or stopping such carriages.—J. Hunt. Horse hay forks (com.)—N. Clayton and J. Shuttleworth. Travelling jib cranes.—J. Robinson. Street-sweeping machines.—E. Russ. Taps or cocks for liquids and ferrules for inserting taps in casks or other receptacles.—J. A. Voisin and P. Dromnier. Method of and apparatus for producing a light.—H. A. Bonneville. Brakes and coupling for railroad cars (com.) (Complete specification.)—T. Short. Apparatus for purifying sewage.—G. Bourne. Machinery for making metal tubes.—E. Jones and A. Howatson. Anti-fouling composition or paint.—G. E. Harries. Brushing-boot for horses.—E. Pearson. Water closets and taps for the same, also applicable to other purposes.—E. Pearson. Taps, cocks, or valves for adjusting or regulating the flow of liquids and gaseous fluids.—R. Ballingal. Instrument for measuring and registering the force or pressure of the wind, such instrument to be known as Ballingal's self-registering anemometer.—C. Goodman. Sewing machines.—J. H. McCarthy. Metallic tubes for locomotive, marine, and other steam-boilers.—A. Mosley. Combination of appliances connected with lace machines.—G. Warsop and H. W. Hill. Rock drill apparatus, applicable also to apparatus for dressing stone, driving piles, rivetting, and such like.—J. B. Bradshaw. Hoods for securing bales.—M. Balsham. Core tubes for boring machines.—C. W. Vosper. Sewing machines.—D. P. Wright. Arrangement for filling, and indicating when full, petroleum and other lamps.—A. V. Newton. Embroidery attachments applicable to sewing machines (com.)—A. Turner. Manufacture of elastic and non-elastic and fabrics and fringes.—W. Smith, sen., and J. Smith. Apparatus for breaking stones or other hard substances.—J. Pattison. Automatic hydraulic apparatus for working pumps and compressing air.—W. E. Gedge. Machine or apparatus for tawing or dressing skins (com.)—W. E. Gedge. Instrument or apparatus termed the "Manducator," intended for crushing and preparing food for consumption by men and animals (com.)—L. Ellis. Pulp strainer said rotary strainer.—W. E. Gedge. Apparatus or boiler with lateral receivers and heating by continuous circulation (com.)

On April 6th.—1194 to 1201.—W. Higginbotham. Door fastener, specially applicable to railway wagons.—C. Anderson. Machinery or apparatus for making paper bags.—F. Morgan. Vessels or apparatus for containing beer and other liquids.—H. Callaghan. Manufacture of benzoline and other lamps.—F. Broughton and R. Stephens. Continuous action steam break.—C. Clamond. Thermo-electric piles.—G. H. Forbes. Method of utilising the foul lime of gasworks.—W. R. Lake. Steam engines (com.)

On April 7th.—1202 to 1213.—W. F. Bateman. Making spaces in condenser doffers.—D. Morris. Preservation of potatoes and apparatus connected therewith.—J. Stephenson and J. Pickup. Furnaces and fire-bars used therein.—J. Needham. Breech-loading fire-arms.—S. Holmes. Optical instruments.—S. Peters and W. Donald. Water-closets, and supply or discharge of various liquids.—G. Kearsley. Reaping and mowing machines.—J. Goss and F. Savage. Hoes, applicable for hoeing wheat and such-like crops.—F. C. Matthews. Fire-grates and stoves.—C. W. W. Thomas. Apparatus for manufacturing heating and illuminating gas.—H. W. Hayden. Machinery for rolling metal tubes or rods.—J. B. Pinnock. Wagonettes, phaetons, and other similar carriages.

On April 8th.—1214 to 1226.—C. Villis. Breech-loading fire-arms.—R. Ronald and J. Farmer. Apparatus for regulating the supply of water to water-closets and other vessels.—J. B. Brechin. Apparatus for economising fuel by increasing the heating effects obtainable from ordinary fire-places.—H. Schellehn. Furnaces for consuming smoke and economising fuel (com.)—F. Siles. Life buoy and self-lighting signal.—G. Haseltine. Producing a new article of food from milk (com.)—E. Gatwood. Cases for buffer springs.—J. Day. Thrashing machines.—R. A. Hunter. Apparatus for supplying water to steam boilers.—G. Haseltine. Water meters (com.) (Complete specification)—H. Chapman. Cooking ranges. J. H. Guest. District and fire-alarm telegraphs.—E. Anduze. Machinery appropriated to pound and to triturate every kind of materials without exception, whatever their nature and their resistance.

On April 9th.—1227 to 1240.—H. W. Hammond. process of preparing a chemical conserved tobacco, free from nicotine and ammonia (com.)—T. Charlton and G. Charlton. Means for stopping or plugging up boiler or other similar tubes.—C. J. L. Leffler. Moulds for casting ingots.—H. A. Bonneville. Oiling or lubricating spinning or other spindle collars, bearings or axle, and other guides of machinery (com.) (Complete specification).—J. Clark. Mariners' compasses.—W. R. Lake. Machines for screwing the uppers to the soles and heels of boots and shoes, and for uniting belts, hose-pipes, and the like (com.)—E. H. Crisp. Arrangements for preventing injury to passengers travelling in railway carriages when collisions or other similar accidents occur.—C. J. Corbitt. Bags or other receptacles and frames for the same.—J. Pinker and T. A. Adamson. Removing and replacing the blades of screw-propellers of ships and other navigable vessels while afloat, and apparatus employed therefor.—G. W. Reynon. Apparatus for self-regulating and adjusting the wires of distant and other railway signals and for other similar purposes.—J. Gill. Pressing of bricks.—M. Ziegler. Manufacture of varnish.—J. Grantham. Tramway cars.

On April 10th.—1241 to 1251.—J. Greenslade. Steam ploughing machinery, and the engines employed in working the same, part of such improvements being applicable for other purposes.—W. L. Wise. Apparatus for the germination of grain, the manufacture of malt and the drying of corn, fruits, peat, and other substances (com.)—W. R. Lake. Water meters (com.)—J. Harrison. Refrigerators and ice safes, cooling by the solution of salts, and the regeneration of the materials employed.—T. Eastman. Hair-pin.—P. Brannon. Mode of employing and combining certain materials for structural purposes. (Complete specification.)—G. T. Bousfield. Rotary engines (com.)—J. Willby. Self-acting mules.—W. G. Schoof. Lever escapement mechanism. (Complete specification.)—J. H. Cohrs. Railway couplings, and appliances connected therewith.—C. Grouhman. Electric apparatus for indicating the progress of trains on railways.

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"A Report on the Rainfall of Barbadoes, and upon its Influence on the Sugar Crops," by Governor Rawson, C.B., has just been received. It not only gives the yearly, and monthly, and daily rainfall since 1847, as recorded at three stations in the island, but it examines the influence of elevation and of the changes of the seasons, and gives with great care the conditions of the sugar crops in relation to the rainfall This report must prove a useful contribution, tending to advance our knowledge of the laws which regulate the distribution of rain, and it may possibly suggest similar compilations in other parts of the globe.

The King of the Belgians opened the Agricultural Exhibition on the 27th ult., and was enthusiastically received by the citizens.

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AND RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

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THE TITLE-PAGE AND CONTENTS FOR THE EIGHTH VOLUME OF THE "SCIENTIFIC AND LITERARY REVIEW" ARE ISSUED WITH THIS NUMBER.

APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

Further information as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur street, Charing Cross.

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Scientific and Literary Review,

AND RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES.

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE

AUGUST 1, 1874

EDUCATIONAL ENDOWMENTS.

The promotion of advanced education for the people of that practical scientific kind which is sometimes termed technical education rather than that of the old classical and abstract mathematical order, is, to us, a matter of the very first importance, since we believe it to be just the kind of education which the maintenance of the industrial position of the country stands in need of; from embracing those branches of knowledge which are useful in practical life, whilst they enlarge the sphere of thought by teaching that the things around us are worthy of more than a passing glance or occasional appropriation to our wants, it being quite true that we may find

"Sermons in stones, and good in everything,"

not only in the religious didactic sense appreciable by the man of piety and the moralist, but also in a sense which readily commends itself to the philosopher.

We are not of those who would in any way diminish the dignity or underrate the value of scholastic lore of the old kind; it has been, and will, doubtless continue to be, valued by the theologian, the orator, the scholar, and the gentleman; but the thoughts of the great men of antiquity have now been so well presented to us by the labours of learned and talented translators that the study of them in their original languages is not nearly so important as in years gone by, and as this kind of study and its concomitant academic routine, which deal with words rather than thoughts or things, has, in public estimation, obtained the supreme position as the right sort of mental training for all who wish to obtain what is termed a respectable position in society, there is no danger of this system of education being underrated, though it is probably much overrated.

Regarding the educational question in this way we cannot say that we feel any great regret that the present Government, by its unadvised action in relation to our system of endowed schools — in other words, our secondary or advanced schools, or grammar schools—should, by such action, have made the subject of endowed school education a principal topic of the day, for we hope that an opening will thus be afforded for a successful public movement in favour of turning most of these schools from mere seminaries for classical learning and religious teaching, according to the formularies of a particular religious body, into endowments for advancing that kind of practical education we have referred to

Whatever may be the fate of that part of the Endowed Schools Act Amendment Bill (at the time we write before the Legislature) restricting the benefits of such schools to one religious body, it seems likely that the present Endowed Schools Commissioners will be got rid of, and we cannot say that we are sorry to think it will be so, for they are men who have neglected great opportunities for doing immense public good. The Commissioners might have endeavoured to render these school endowments supplemental to our elementary school system, by providing schools where the education of intelligent children of working men and other unwealthy persons could, by reason of the pecuniary aid afforded, be continued, so that such children would become well instructed in the use of the English language, and especially in all the practical sciences, thus fitting them to go forth into the workshop or the warehouse with a stock of really useful knowledge, that would enable them to become first-class workers in our industrial and commercial establishments, and with minds capable of broad views of the things of life around them. Instead of doing this, the Commissioners seem to have done little else than split up schools which professed to supply a high-class education of the old-fashioned kind into a larger number of schools, in which the same kind of education, somewhat diluted by modern "ologies," should be afforded to the children of parents of tolerable pecuniary means, who must pay fees for teaching alone amounting to nearly as much as many a good private school would undertake to teach and feed children for.

Truly this question of public education is by no means well understood. We have in this country magnificent pecuniary provision for education, but what becomes of it? A large portion is applied to the benefit of our rich noblemen and gentlemen who have invaded the patrimony of the poor at such institutions as Eton, and other public schools of that class. Another large portion is appropriated by the well-to-do sections of the middle-class, whilst for the poorer sections of that class, and the working classes generally, something is done in the way of supporting such institutions as Dickens termed "Charitable Grinders," which are powerful agencies for moral debasement, and powerless for advancing education.

It must never be forgotten that the wage classes are persons who cannot afford to keep their children away from industrial employment after the age fixed by the elementary school; very many cannot afford to do that much, hence, however intelligent a child may be, he has no chance whatever of obtaining any secondary education worth speaking of unless he obtains some endowment whereby he is both taught and fed; and it must be remembered that even then, the loss of the wages the child might soon earn would be likely to be missed from the weekly pittance, so that, under even these favourable circumstances, the parent would sacrifice a good deal for the child's future advantage. Thus, no system which does not give absolutely gratuitous instruction, and afford the means of living, aye, further, have an eye to the subsequent placement of children in industrial and commercial life, will be any great public good.

Of course, when we write this, we do not mean that endowed advanced education ought to be given to every poor child, for we assume it will be extended to such children only as upon examination are found to promise to benefit by it. Nor do we advocate that when a child shows a decided bent for classical, literary, and other scholastic studies, opportunities for encouragement of his talents should not be provided.

But independently of schools technically so-called, we have amongst us educational agencies that have never yet received the recognition and encouragement they deserve; we allude to the institutions termed Birkbeck, Mechanics', Working Men's Literary and Scientific, and so forth. Whatever may be their shortcomings, they are, without doubt, People's Colleges; and, if some small portion of our educational endowments were bestowed upon them upon conditions judiciously framed, so as to induce a larger number of the intelligent youths of the wage classes to make use of them, they are quite capable of doing much good for the educational advancement of the people: because they do not necessitate the withdrawal of youths from the active business of life. But to make these institutions extensively useful they generally require to be assisted in the matter of rent and building, and to fill them prizes for attendance and for merit should be liberally provided for. Indeed, something in the way of evening schools might be combined with these institutions.

We are well aware that to fully advance technical education all this must be followed up by a system of technical colleges and universities conferring technical degrees; and it would be well if something could be done to endow such institutions.

However, as we find by the *Times* that working men have been giving attention to the subject, we hope that we shall soon have to speak of something practical being done.

Reviews.

ENGLISH SALMON FISHERIES

"Thirteenth Annual Report of the Inspectors of Salmon Fisheries (England and Wales)." London. Eyre and Spottiswoode. 1874.

GIVEN a subject which requires Government intervention and the right men appointed to act in the matter, and anyone, though not a prophet, or the son of a prophet, may safely predict a satisfactory result; therefore, whilst we have two such men as Dr. Buckland and Mr Walpole acting as Inspectors of Salmon Fisheries, no one will feel surprised at public approbation being bestowed on their labours. That their labours have been considerable, and that they have been attended with great advantage, no one who duly considers the question can doubt. It does not require anyone to be very old to remember the time when salmon was very much more plentiful, and consequently cheaper, than it now is, and, also, that it afterwards so increased in price till it became considerably higher than it is at the present time, this was owing mainly to pollution of salmon streams, and also to the non observance of "close time." These two evils have been well met by the Government Inspectors, and the Blue-book before us details the inspectorial work during the past year.

Mr Buckland's report, as might be expected, is practical and scientific. As regards the price of salmon, he says:

Salmon at the beginning of the season of 1874 were remarkably cheap, falling as low as 10d. per pound, whereas the general price per pound for spring fish is 2s. 6d. The credit for this unusual supply of fish may be said to be due to the products of Scotch and Irish fisheries. It is, however, certain that the fisheries of England and Wales have contributed largely to the abundance of salmon in the spring of 1874 and to the reduced price of fish in July in August 1873.

The pollution of rivers naturally received much attention from the inspectors on this subject which Dr. Buckland justly viewed as of far larger public importance than as it affects salmon fisheries. He says:

The question of the future treatment of pollutions of rivers demands most serious attention from the Legislature as representing the interests of the public. It is obvious that all legislation will be of little or no avail if the water in which the fish live and breed is unsuited for their existence. The question of the pollution of rivers is too large to be treated by those interested directly or indirectly with salmon culture, it practically and directly concerns every individual of her Majesty's subjects. The question of pollutions of rivers is therefore really the principal question of the day.

Pollutions may be generally classified thus:

1. Pollutions from towns.
2. Pollutions from mines.
3. Pollutions from manufactories.

I am sorry to report from my own observation, that most of our rivers are more or less utilized as sewers by the towns upon their banks. As notable instances of this, I give the Severn, which is made to receive the sewage of Gloucester and Worcester, &c. The Ribble is terribly fouled by the pollutions of Preston. The fishermen of the Cumberland Eden complain of their nets being frequently filled with the sewage of Carlisle. The state of the Exe from the sewage of Exeter, just above Trews weir, demands the immediate attention of the local authorities. The manufactories of the Tyne persist in pouring out poisonous substances from Burrows creek. Seaton seriously injures the Devonshire Axe. Canterbury sewage handicaps the efforts of the conservators to restore migratory salmonidæ to the Stour. The Medway can now be hardly called a river at all, but is rather a "pactolus," the waters of which are of the most impure nature, threatening great mischief some day to the inhabitants of Maidstone and its neighbourhood. The town of Taunton has taken steps to divert its pollutions from the Tone, but at my late visit the river by the sewer presented a state of filthy mud.

There are many other cases of pollutions of towns injuring rivers, but I have not space to mention them all. The question of the disposal of town sewage is difficult of solution, while, at the same time, considerable expenditure of capital is required to carry it into effect.

It is perfectly obvious to my mind that the land and not the river is the proper place to receive town sewage. I give at page 55 of this present report an analysis of sewage falling into the Ribble. From this it appears that the chemical ingredient which most abounds is ammonia. Now ammonia is a substance highly prized by farmers, and it seems strange in these days of scientific engineering, combined with the progress of practical and agricultural chemistry, that large sums of money should be yearly expended by our farmers to purchase from abroad ammonia and phosphates, while at the same time tons of these valuable substances are poured into the water, and sent drifting down our rivers to poison not only the fish, but also the people who live lower down the river. It is unfortunately often necessary that waterworks (notably in the case of the Thames) are obliged to pump up into dwelling houses water which but a few miles above was highly impregnated with sewage. It is impossible that any amount of filtration can ever render the water as pure as it would be if the sewage had never been put into it at all. This is a fact unpleasant to think of, but yet I wish the public to realise that it is a fact, as then and then only will it be made imperative for the authorities of all towns either to convert the sewage into food for plants instead of poisoning the fish, or else send it down by means of pipes or culverts, to waste places where it can do no mischief.

I make it my business to examine the mouths of all sewers flowing into salmon rivers, and am therefore practically acquainted with the great injury that accrues to salmon fisheries through town sewage.

The arrangements for facilitating the breeding of salmon, as might be expected, received much attention. However no particular passage will illustrate this since, at many different pages, the subject is referred to.

As to close time, which receives much attention, Dr. Buckland makes the following general statement:—

I do not hesitate to state that there ought to be a close time, or else a regulation for the mesh of nets, for sea fish within the three mile limit during certain weeks of the spring months, when the sea fish come from the deep towards the shore to spawn.

The report of Dr. Buckland gives a table of returns of salmon sold at Billingsgate, supplied to him by Messrs. Forbes, Stuart, and Co., of Lower Thames-street, and concludes as follows:—

The table shows a slight increase in the number of English salmon sold in Billingsgate and a considerable increase in the number from Scotland and Ireland. In taking these figures into consideration, it must not be forgotten that the bulk of Scotch salmon is sent to London, and large numbers of Irish fish are exclusively sold there, while the markets for English fish are not merely in London, but in all the large provincial towns, in the neighbourhood of which salmon are caught.

In concluding this report, I have great pleasure in expressing my satisfaction with the present condition and future prospects of the salmon fisheries of England and Wales. The public owe very much to the chairman and members of the Boards of Conservators throughout the kingdom for their most praiseworthy exertions to carry out the law and to increase the supply of public food. Nor must it be forgotten by any interested in the multiplication of salmon as well as in the commercial aspect of this important branch of national industry, that great thanks are due to the Select Committee of the House of Commons and especially to Mr. Lewis Dillwyn, M.P., chairman of the committee, for the labour and pains they have bestowed in framing the new Act of 1873.

That this new Act is a wise measure carefully cast in accordance with natural facts and with due consideration for all rights and interests there can be no doubt. I venture, therefore, to hope that we are now in 1874 entering upon a new era of increased prosperity for the salmon fisheries of England and Wales.

Mr. Walpole's report is a very comprehensive and detailed account of the working of the Salmon Fisheries Acts, and concludes with the following important remarks as to the pollution of rivers:—

If, then, river preservation is to be continued, some steps must be taken to remedy the evils of river pollution. No one can doubt that the time is ripe for the change. A very able Commission has, in a series of very able reports, dealt exhaustively with the whole subject. The Government has displayed its anxiety to deal with it by attempting to give legislative effect to the recommendations of the Pollution Commissioners. An independent nobleman has reproduced in the House of Lords the proposals which the Government had made in the House of Commons, and a Select Committee of the former House has pronounced its opinion in favour of the reform. It cannot, then, be urged that the time for remedial legislation has not yet arrived. The points on which legislation must be founded are clearly before the country. From what I have already said it will be seen that I do not advocate reform on this subject merely on fishery grounds. The demand for pure water rests on higher grounds, and it is only a subsidiary advantage that the production of fish will be increased by the change. But it cannot be too distinctly understood, that, unless some such reform is carried, our fisheries are threatened with a gradual decay. Neither legislative nor administrative efforts can compensate for the want of pure water, and pure water is, in this country, gradually becoming more and more scarce. If, then, the efforts of our Conservators are to be attended with the success which they deserve, some steps must be taken to remedy the evil of river pollution. In default of such a remedy our rivers can never produce the amount of food which they might otherwise easily yield.

Appendices give tabular statements as to various matters coming under the cognisance of the inspectors. On the whole, this is one of the most practical and readable of Blue-books, conciseness and precision being equally well attended to.

ACCIDENTS ON RAILWAYS

"A Treatise upon Railway Signals and Accidents." By ARCHIBALD D. DAWNAY, Assoc. Inst. C.E. London. E. and F. N. Spon. 48, Charing Cross. New York. 446, Broome-street. 1874.

THIS is a very useful compendium of scientific and practical information on those important subjects, railway signals and railway accidents. The work is divided into several parts:—1. The development and form of signals in use upon railways from the earliest time, which seems to be a succinct yet comprehensive statement of that part of the matter. 2. The various patents and improvements deserving of notice, which to our mind is not so complete as it might have

been, for the writer seems to have confined his notices (which, it must be owned, are fairly descriptive, and often accompanied by illustrative cuts) to those plans which have been brought into use or actually tried, but we think he would have found some practical merit amongst those which at present only exist on paper or parchment amongst the Patent Office records; for instance, the locking gear, patented not three years since, by J. Ford, of Reading, may be considered to be worthy the attention of practical men. However, Mr. Dawnay would doubtless clear himself on this head by pointing to the size of his work, which is that of a thick pamphlet. The third part of this useful production relates to the practical results of the several systems deduced from the accidents which have occurred, a portion of the work of a very satisfactory character, as is the fourth part, which is devoted to the consideration of what method of signalling and working of traffic appears most desirable to ensure safety. In an appendix much information is given as to Board of Trade requirements and recommendations also important correspondence between that Board and the railway companies.

PICKERING ON PHYSICAL MANIPULATION.

"Elements of Physical Manipulation." By Edward C. Pickering, Thayer Professor of Physics in the Massachusetts Institute of Technology. Part I. London: Macmillan and Co. 1874.

This work is, we may say, a peculiar one, and we cannot call to mind one of the same character, and based on the same footing. It is by an American author, and written as a text book to be used by the student in the laboratory for teaching physics. The author informs us that to meet the wants of the student of physics the present work has been prepared, based on experience gained in the Institute of which he is one of the professors.

The work opens with a chapter devoted to general methods of investigation, analytical and graphical, and the more common applications of the mathematics to the discussion of results. The graphical method, with some new developments of it, is compared in this chapter with the analytical method; a short description of the various methods of measuring distances, time, and weight; the chapter, as a whole, being intended, the author says, as a ground-work of a short course of lectures given to the students before they begin work in the laboratory. After this preliminary chapter that part of the work follows which bears on the various branches of physics, a peculiar point being the arrangement of its contents, each experiment being divided into two parts, the first called Apparatus, giving descriptions of the instruments required, and designed to aid the instructor in preparing the laboratory for the class; this the student is first to read over, and with it the second part, in which each experiment is divided, entitled Experiments, which explains in detail what he is to do.

In the description it is assumed that each set of apparatus for each experiment is confined to one table, and this, to say the least, would entail considerable expense as it would mean having duplicate sets of apparatus of costly instruments, which only a college or laboratory with a large endowment could afford, but, of course, we would assume that where the same piece of apparatus was wanted for another experiment it might be moved.

Chapter II. contains 22 experiments bearing on the general subject of physics; the next chapter having 20 experiments on the mechanics of solids, amongst which are experiments on composition of forces, coefficient of friction, and the laws of tension, and torsion. Falling bodies, and the mechanics of liquids and gases forms the next chapter, which contains 18 experiments.

Chapter V. is taken up by sound, on which important subject only 6 experiments are given; and the next and concluding chapter of this part is occupied with 28 experiments in relation to light.

We have thus given a *resumé* of the contents of this part of the work, which is clearly and ably written, and we cordially recommend it to the careful consideration of every teacher and student in physics who should have it always by him. We like this first part so well that we shall await its continuation by the second part bearing on heat and electricity as promised by the author.

SIR W. GROVE'S CORRELATION OF FORCES.

"The Correlation of Physical Forces" (sixth edition), with other Contributions to Science. By the Hon. Sir W. R. Grove, M.A., F.R.S., one of the Judges of the Court of Common Pleas. London: Longmans, Green, and Co. 1874.

Although, as regards correlation of physical forces, this is the sixth edition, and the other matter has already been brought before the public, yet the importance of the subjects treated, and the philosophical eminence of the author, induce us to now state, for the benefit of such of our readers as it may concern, that this work, containing, as it does, various contributions to science of the highest interest, embraces a vast field of philosophical thought and experimental research, in a way in which not only scientific men, but any man of education and intelligence can follow the author with profit; and further, that we intend to give a more detailed account of its contents hereafter.

REVIEWS POSTPONED.

We are compelled to postpone our reviews of the following books:

"Tyer's Block Telegraph and Electric Locking Signals" (fifth edition).

"Rules of Evidence as Applicable to the Credibility of History." By William Forsyth, Q.C., LL.D., M.P.

"Influence on Homœopathy in General Medicine since the Death of Hahnemann." By R. E. Dudgeon, M.D., Edin. London: Henry Turner and Co.

"Early History of the Property of Married Women." A Lecture by Sir H. Maine. Manchester: A. Ireland and Co., printers.

CARMICHAEL'S ANTI-WAVE SHIPS.

At the meeting of the Inventors' Institute, on June the 11th, 1874, Mr. C. G. Carttar presiding, the discussion on the subject treated of in Dr. Carmichael's paper, with the above heading, which we have already placed before our readers, was the business for transaction that evening.

The paper having been read, the Chairman stated that as it had been published in the Journal of the Inventors' Institute nearly two months ago, and as it referred to a most important matter—the neutralisation of the effect of the waves on sea-going vessels—it would, he hoped, be discussed in a comprehensive and exhaustive manner.

Mr. Murray remarked that in ship-building all straight lines were wrong, and therefore he thought Dr. Carmichael would do well to modify his invention, so as to reduce straight lines to curves. As regards the use of a screw propeller in a tube, he feared that arrangement would not propel well; and such a vessel as that of Dr. Carmichael's, he considered, could not be steered unless the rudder was of the length of half the beam of the vessel. The author of the paper seemed to think it would be of advantage if his vessel should be like a log on the water, but all his (Mr. Murray's) experiences of sea voyaging convinced him that a lively boat was what seamen liked. At the same time he was quite ready to admit that Dr. Carmichael's vessel was not likely to be thrown on her beam ends.

Mr. Calley said that his experiences would lead him to doubt whether the sloping sides of the vessel would, in a heavy sea, slope at all; rolling of 27° would very nearly bring the side to a level, and he could not see that the mode of propelling by means of a screw enclosed in a tube could be a good practical arrangement, for as far as he could see there would be a choking action.

Mr. M. M. Harris remarked that in the United States there were plenty of flat-bottomed or approximately flat-bottomed ships of large size, which were found very satisfactory; and Dr. Carmichael's ship, if not flat bottomed, was what might be termed flattened at the bottom. Although the various objections already urged were very cogent, yet he considered a vessel constructed as described would possess the great merit of being arranged in accordance with sanitary principles.

Mr. Morgan thought that in discussing this matter an erroneous assumption had been adopted, namely, that the form and construction of the vessel were inseparable from the propelling arrangement, but this was, in reality, not so. The peculiar construction of vessel could be adopted with any other suitable means of propulsion.

Mr. Carttar considered that after all due weight had been given to the various objections to Dr. Carmichael's plan, there yet remained a favourable view of it, which appeared to be of great importance, namely, that it would be a vessel little agitated by the waves, and not liable to be upset, and consequently well adapted for giving effect to sanitary principles. Further, although so much objection had been taken to Dr. Carmichael's proposition, yet the invention was one of considerable importance, and he would now close the discussion by moving a vote of thanks to Dr. Carmichael for his interesting paper.

Mr. M. M. Harris, in seconding this vote of thanks, would take the opportunity of mentioning that this was the last members' meeting of the session, which he thought everyone would agree had not been a barren one, whether as regarded the topics of discussion at the meetings or the way in which they had been dealt with. In no case had the matter for investigation been wanting in practical importance or its course other than comprehensive and practical. He was glad to know this was the real state of the case, for he considered it of the very greatest importance that the Inventors' Institute should be, *par excellence*, a practical body, quite alive to the eminence and importance of pure science, but always more interested in the practical than the philosophical phases of scientific research. Though inventors were not numerous, they were doing what was, without any exception whatever, the most important work for civilized life, and, therefore, their Institute must in all consistency keep far away from the character of *dilettanti*, would-be improvers of arts, manufactures, and commerce. Amongst the various questions suitable for consideration, the Patent Laws had not been forgotten and he was happy to say (as they would learn from the Journal of the Institute) the matter had been put in train with the present Ministry in such a way that he hoped before the next session of the Institute commenced some arrangement in furtherance of Patent Law Reform might be come to with them. In the hope of a happy reunion with his friends and fellow members next session he would now wish them health, wealth, and happiness, not forgetting holiday enjoyment.

Mr. Carttar supported the vote of thanks to Dr. Carmichael, which was carried unanimously.

Mr. Morgan moved and Mr. Murray seconded a vote of thanks to the Chairman, which was carried unanimously, and this terminated the meeting.

Correspondence.

GOVERNMENT INDIFFERENCE AND INVENTORS' RIGHTS.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—Nearly two years since, in your October issue for 1872, you allowed me to review and analyze the composition of the Patent Laws Special Committee, then sitting in the House of Commons.

To any of your subscribers taking the trouble to read that analysis, with the conclusions arrived at by me from it, they will appear in the main fully proved. The Committee has, since then, again sat, done what was intended, viz., hatch an addled egg, bamboozle both inventors and the public, report to the House, and do nothing; in all which they have succeeded to perfection.

My attention is again specially drawn to the patent grievances by your correspondence with the three principal State officials, published in your last number. Your letter invited conference with them on the reduction of stamp expense, with other projected amendments of patent law, upon which the deputation you proposed could have considerably enlightened the Government. Let us examine the nature of the replies you received.

The Chancellor of the Exchequer is refreshingly candid; with admirable simplicity he admits his ignorance of the whole matter; and although a leading part of the subject is fiscal, and legitimately within his department, he declines inquiry

The Lord Chancellor pleads the stereotyped pressure of business, or, in other political words, you are too ridiculous to be important. But the cream of all is the Premier's answer (whom I should be sorry to think laughed when sending it you). "If you will submit your statement in writing, it shall have my best," &c, &c And so ends the farce.

Sir, there is but one mode of altering this studied indifference to the interests of inventors, interests upon the proper protection of which I affirm much of our national prosperity and commercial supremacy depends.

It is the deliberate intention and gain of capital to steal the brain of invention. To this end much of its force is energetically directed. To it it is ever alive, while the inventor, poor simpleton, sits mildly by, supinely looking on at the act of spoliation, now and then spasmodically starting up from the reverie he has fallen into to find himself systematically cheated of his first fruit and reward

There is no royal escape from this; inventors are but units in the aggregate body politic, who, if they desire protection, must fight like the rest of common mortals for recognition The public will never know of their claims unless allied with proper discretion—they are loudly uttered. Discretion is present in the Institute, but where is the requisite force? It is not enough that there should be an Inventors' Institute with official staff, labouring to obtain justice for its clients. Such labour, however well directed, will fail of its object unless actively supported by the clients in whose interests it is made. To meet periodically; to hear a paper read; then for ten minutes to admire, by resolution, the indefatigable zeal of the president, secretary, and so forth, to criticise a report and prospect without adding force to advice, is but another edition of Sisyphus stone rolling.

Let me venture to indicate the present pressing duty of inventors. If they are asleep to their interests their enemies are not. It is assuredly an intention as soon as it can be decently accomplished, to abolish all patent protection. The indifference not of this Government alone, but of all Governments in listening to inventors' plaints sufficiently shows the direction of the current. All parties, therefore, concerned cannot too quickly look to it. Let them read the digest of the committee's evidence and reports, given in former numbers of this Review. They will soon learn how their rights are strained away and jeopardised. Let that knowledge be followed up by each one writing to his M.P., wholly repudiating the report as being drawn from fallacious data by those notoriously opposed to all protection.

The present Patent Laws, by means of the varied tinkering and muddling of past years, are now in such a delightful state that no one's rights are assured by them, save that the most successful under them obtain the right to litigate, a terrible instrument in the hand of the capitalist, but a crushing curse to the poor inventor. Still, although there has been so much legal rubbish foisted upon them, the underlying principle of our Patent Laws is to give legal protection for invention, which, however, persistent capitalist legislation has so befogged, to the end that they may be swept away as a common nuisance with the consent of the community. Assuredly this is not the aim of inventors. Their interest is cheap, swift, and certain protection for their indubitable right of property in their own products. No committee of the House as at present constituted will concede this, while *ex parte* legislation must not be for a moment considered Unless Government and the Legislature is prepared to accept as the basis of a Bill the suggestions of the Inventors' Rights Bill, which you have repeatedly published, founded upon conclusions come to after careful study, combined with an intimate acquitance with the matter, the requirement is a full and efficient examination into the whole state of the laws on this subject. Committees of the House at best, for want of time, cannot deal with these, their forte is special questions, with a necessarily circumscribed range of vision. What is wanted on a subject of this importance is a Royal Commission, upon which every phase of interest, prominent amongst others that of *working men*, could be represented, and which, comparatively speaking, unlike a sessional committee of the House, would neither be tied to time or place of sitting; it could gather evidence anywhere and everywhere, and, as in the case of the Friendly Societies Acts, by the help of assistant commissioners, present us with an exhaustive report on the whole question, which is now in too complex a condition to be summarily dealt with by doctrinaires of any school.

If legislation of the right kind cannot now be had, for a report of this character we can afford to wait two, or even three, years Certain I am that its publicity would compel justice being done to an oppressed, but very essential, class in the making-up sum of our general weal.

THOS. MOTTERSHEAD.

Lambeth, July 15th.

ANCIENT ROME.

AT the meeting of the Royal Society of Literature on the 24th of June, 1874, C. Clark, Q C, in the chair, Mr. Vaux read an interesting paper "On the Commerce of Ancient Rome with the East," in which he traced, at considerable length, the course of trade between the West and the East from the time of Solomon to that of Justinian, showing that the Romans were the inheritors of a commerce long previously existing, chiefly from the time when Egypt became a Roman province after the battle of Actium.—Mr. Vaux expressed his opinion that Roman influence in India was very great in the first three centuries of our era, and pointed out that this was confirmed by the constant discoveries of Roman gold coins of the Empire in Southern India. At the same time, he did not endorse the views of universal sovereignty put forward in France by M. Reinaud and M. Beulé.

OBSERVATIONS ON AN ECLIPSE.

AT a recent meeting of the Astronomical Society, Professor Adams, President, in the chair, a paper by Mr. Stone, the Government Astronomer at the Cape of Good Hope, was read, describing his observations of the eclipse of the 16th of April, made near Klipfontein, in South Africa. Just before the total phase the slit of his spectroscope was placed tangentially at the centre of the disappearing crescent. At the instant of totality the field of view of his spectroscope appeared full of bright lines, but the greater number of them quickly vanished, leaving only the ordinary prominence spectrum. He next examined the spectrum of the corona at some distance from the moon's limb, and found it to consist of a faint solar spectrum, in which he could with certainty trace the principal dark Fraunhoffer lines and of one bright line, the position of which he measured, and found it to coincide with 1474. Mr Bidder described a micrometer which he had contrived for measuring the position of very faint stars. Ghosts of the wires, which can be rendered dimmer or brighter at the discretion of the observer, are projected into the field of view by means of reflecting prisms, and diaphragms can be used, cutting out the light of the wires from any portion of the field. M D'Abbadie was called upon to give some account of the French preparations for the Transit of Venus. The French Government will occupy five stations, and will make use of the Daguerreotype in preference to the collodion process Their photographs will be taken in the principal focus of the instruments, and the image of the sun will thus be only about 38 millimètres in diameter. The trial photographs are so sharp that they hope to be able to make use of magnifying power of 250 in measuring the photographs for the purposes of reduction. Lord Lindsay described the results of his experiments in photographing the appearance which is known as the black drop,—and Mr. Ranyard described some experiments which he had made as to the production of the black drop when viewed by the naked eye and through lenses. The President announced to the Society that a petition was about to be presented to the Dean of Westminster, praying him to admit of the erection of some memorial to Jeremiah Horrocks in Westminster Abbey. It was announced that the next meeting of the Society would be held in their new rooms in Burlington House.

AN ANCIENT CHINESE CAPITAL.

AT a meeting of the members of the Asiatic Society held on June 22nd, at which J. Fergusson, Esq., vice-president, in the chair, an interesting paper, by Dr. S. W. Bushell, "On the old Mongolian Capital of Shangtu," was read. This city was founded in A.D 1526, when the Emperor Hsin Tsung ordered his brother (a successor) to occupy the territory and to form a military encampment there. In 1268 Shangtu was made the seat of a governor-general. It is situated twenty seven miles north-west of Dolonnor, which Abbé Huc wrongly supposed to have been built on the site of the ancient city. After the fall of the Yuan dynasty it rapidly diminished in importance, and was finally abandoned by the Chinese in A.D. 1430. The ruins were visited by Dr. Bushell and the Hon. T. G. Grosvenor on September 16, 1872. The walls, built of earth, faced with unhewn stone or brick, are still standing, though more or less dilapidated. They form a double enceinte, the outer with six, the inner with three gates, one of which, a perfect arch, 20 feet by 12 feet wide, is still intact. The ground in the exterior of both inclosures is strewn with blocks of marble and other remains of large temples and palaces, broken lions, dragons, and remains of other carved monuments lying about in every direction. An inscription of the Yuan dynasty in an ancient form of the Chinese character has been copied by Dr. Bushel.

THE

SCIENTIFIC AND LITERARY REVIEW,

AND

Journal of the Inventors' Institute.

VOLUME VIII.

"Scire velis, mea cur ingratus opuscula lector
Laudet ametque * * * *
Non ego ventosæ plebis suffragia venor,
Non ego nobilium scriptorum auditor et ultor
Hor., Ep. I. 19.

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ESTABLISHED 1ST MAY, 1862.

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SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

President of Council:

SIR ANTONIO BRADY.

TO MEMBERS OF COUNCIL.

Council Meetings on Thursdays, August 13th (monthly special) and 27th. Executive meetings at the same time.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts. F. W. CAMPIN, Sec.

Proceedings of the Institute.

AT the meeting of the Council (ordinary and special) held on 18th June, 1874, F. H. Varley, Esq., Vice-President of the Council, in the chair, the minutes of the last meeting having been read and passed, a letter from the Right Hon. B. Disraeli, Prime Minister, was read, declining to receive a deputation on the Patent Laws, but requesting communications from the Institute thereon; and after some discussion this was ordered to stand over for further consideration, and thereupon the Council adjourned till Thursday, 25th June.

At the adjourned Council after much consideration it was decided that the subject must stand over for the present.

At the meeting of the Council (monthly special) the minutes were passed, and the following new members recorded, viz., Messrs. Kirkwood, Dix, and Newton; at the same time the executive (or Executive Committee) met and discussed some business arrangements relative to the Journal of the Institute.

Monthly Notices.

A statue of Wilson, the ornithologist, will, in a few weeks, be erected within the burying-ground of the abbey of Paisley, and within a few minutes' walk of the spot where he was born.

The French Academy of Sciences elected, at the Séance of the 8th of June, two correspondents, M. Tholozan, physician to the Shah of Persia, in the section of Medicine,—and M. Studer, in the section of Mineralogy and Geology.

The Reports and Proceedings of the Miners' Association of Cornwall and Devon for the year 1873 have just been issued. Some papers of considerable interest, especially in relation to mineral lodes, will be found in this volume, especially "Remarks on Two Cross-Sections through Carn Brea Hill and Neighbouring Mines," by Capt. J. Maynard; and "Observations on the Elvan Courses, Greenstones and Sandstones of Cornwall, with Remarks on their Associated Minerals," by Mr. A. K. Barnett. These papers are well illustrated, and have a practical and scientific value.

"*The Successor of Steam*" is the title of a brief paper which has appeared in the *Isis*, a physical journal published at Haarlem, in which Dr. H. Beins, of Groningen, advocates the employment "in our common steam and other engines," of liquid carbonic acid, prepared, as he states, cheaply, from "natrium bicarbonate."

Les Mondes states that M. François Désiré Roulin, well-known in connection with the Natural History of Equatorial America, died on the 4th of June last, at the age of seventy-eight.

Platinised Iridium, on being prepared for the International Metrical Commission, at each stroke of the hammer there were produced luminous lines, crossing each other at right angles, passing from one side of the bar to the other. M. Tresca has called attention to this curious phenomenon, which he does not attempt to explain.

Steam, as a fire-extinguisher, has been employed with remarkable effect in the Hidden and Cope Mine, the workings of which are more than 600 feet below the surface. Mr. Henry Coryell has recently read a paper on this before the American Society of Civil Engineers.

The capacity of an electrical condenser was found by Faraday, many years ago, to depend, not only on the form and distance of the metal plates, but also on the character of the intervening insulator. Some experiments have been performed by Herr Boltzmann, of Vienna, with the view of determining the dielectric constants of different insulating media. His results have been communicated to the Vienna Academy of Sciences, and are published in the last number of Poggendorff's *Annalen*.

Osmiridium, that rare mineral, an alloy of the two metals osmium and iridium, has, says the *Athenæum*, been discovered in Gippsland, in the Colony of Victoria. We hear also of valuable deposits of cinnabar having been found in Queensland. As quicksilver is largely employed in the amalgamation of gold-ores, it would obviously be a great gain to the Australian miner to be independent of foreign supplies of this expensive metal.

Mr. Mallet's theory of volcanicity is attracting much attention, and giving rise to considerable discussion. Prof. E. W. Hilgard, of the University of Michigan, presented to the National Academy of Sciences a memoir on some of the points in this theory. Assuming that Mr. Mallet's hypothesis accounts satisfactorily for earthquake phenomena and volcanic activity, as manifested since the cessation of fissure eruptions; and also for the gradual or sudden depression of both large and small areas, even subsequent to that time, Prof. Hilgard contends that it makes no provision for their elevation, and, therefore, leaves unexplained the numerous oscillations of level, of which we find the record in nature down to our own time.

Lord Roseberry will preside over the meeting at Glasgow of the Social Science Congress, and will deliver an Inaugural Address. Sir George Campbell will preside over the Department of Economy and Trade.

Dr. J. E. Gray has been elected a Foreign Member of the Royal Society of Science and Art at Gottenburg, in Sweden.

The American Association for the Advancement of Science holds its twenty-third meeting at Hartford, Connecticut, on Wednesday, the 12th of August, Dr. Le Conte being the President for the year, and Mr. F. W. Putnam, of Salem, Massachusetts, the permanent Secretary.

Proceedings of Societies.

ROYAL SOCIETY.

JUNE 18TH.—The President in the chair.—The following papers were read:—"On the Anatomy of the Lymphatic System," by Dr. G. Thin; "Experiments with Safety Lamps," by Mr. W. Galloway; "A Contribution to the Histology of the Blood," by Dr. W. Osler, "On Coniferine, and its Conversion into the Aromatic Principle of Vanilla," by Messrs. F. Tiemann and W. Haarman; "Researches in Spectrum Analysis in connection with the Spectrum of the Sun, No IV.," by Mr. J. N. Lockyer; "Tables of Temperatures of the Sea at different Depths beneath the Surface, reduced and collated from the various Observations made between the Years 1772 and 1868, with Notes and Sections," by Mr J. Prestwich, "On the Forces caused by Evaporation from and Condensation at a Surface," by Prof. O. Reynolds; "Given the Number of Figures not exceeding 100 in the Reciprocal of a Prime Number, to determine the Prime itself," and "On the Number of Figures in the Reciprocal of every Prime Number from 20,000 to 30,000," by Mr. W Shanks, "Researches on Explosives: Fired Gunpowder," by Capt. Noble and Mr. F. A Abel, "On the Centre of Motion in the Human Eyes," by Mr. J. L. Tupper; "On the Mechanism of Stromboli," by Mr R. Mallet; "On the Employment of a Planimeter to obtain Mean Values from the Traces of continually Self-recording Meteorological Instruments," by Mr R. H. Scott, "On Dredgings and Deep-Sea Soundings in the South Atlantic, in a Letter to Admiral Richards," by Dr. W. Thomson; "On the Diuretic Action of Digitalis," by Drs. Brunton and Power, "Description of the Living and Extinct Races of Gigantic Land Tortoises Parts I and II., Introduction, and the Tortoises of the Galapagos Islands,' by Dr. Günther; "On the Adiabatics and Isothermals of Water," by Mr A. W. Rucker, "Research on the Smallpox of Sheep," by Dr Klein, "On the Physiological Action of the Chinoline and Pyridine Bases," by Messrs J. G M'Kendrick and J Dewar; "On the Sun-spot Period and the Rainfall," by Mr. J. A. Broun, "Some Observations on Sea-Water Ice," by Mr. J. Y. Buchanan, "Contributions to Terrestrial Magnetism, No XIV.," by Sir E Sabine, "On the Calculus of Factorials," by the Rev. Dr. Logan, and "Magnetic Observations at Zi-ka-Wei," by the Rev. S. J. Perry. The society adjourned for the long vacation.

ROYAL INSTITUTION.

JULY 6TH.—The Earl of Rosse, V P., in the chair.—Messrs W. W. Brocklehurst, B. Dietz, W. T. Hustwitt, F. P. Leon, W. Reade, and Dr. C. D. F Phillips were elected Members.

GEOGRAPHICAL SOCIETY.

JUNE 22ND. Anniversary Meeting.—The Right Hon. Sir H Bartle Frere, K.C.B., President, in the chair. The Founder's Gold Medal, for the encouragement of geographical science and discovery, was presented to Dr. Schweinfurth, for his explorations in Central Africa, his discovery of the Uelle River, beyond the south-western limits of the Nile basin, and for his admirable work, "The Heart of Africa," in which he has recorded the results of his travels The Victoria or Patron's Medal was awarded to Colonel P. Egerton Warburton, for his journey across the previously unknown western interior of Australia, from Alice Springs, on the line of overland telegraph, to the western coast, near De Grey River The prizes to public schools for 1874, were as follow:—Physical Geography—Gold Medal, L. Weston (City of London School); Bronze Medal, F. C. Montague (University College School). Political Geography—Gold Medal, W. H. Turton (Clifton College, Bristol); Bronze Medal, L. Jacob (City of London School). It was announced that the special subject for the examination in 1875, both in Physical and Political Geography, would be China. The following gentlemen were elected as council and officers for 1874-5:—President, Major-General Sir H. C. Rawlinson; Vice-Presidents, Sir R. Alcock, Admiral Sir G. Back, Admiral R Collinson, and the Right Hon. Sir H. Bartle Frere; Trustees, Lord Houghton and Sir W. C. Trevelyan, Bart.; Secretaries, C. R. Markham and R H. Major; Foreign Secretary, Lord A. Russell, M P.; Councillors, Sir S. W. Baker, Hon. G. C. Brodrick, Sir G. Campbell, Lord Cottesloe, Captain F. J. O Evans, A. G. Findlay, J. Fergusson, Admiral Sir W. H. Hall, Major-General Sir F. J. Goldsmid, M. E. Grant-Duff, M.P., Colonel J. A. Grant, J. Murray, Sir C. Nicholson, Bart., Admiral E. Ommanney, General C. P. Rigby, Marquis of Lorne, H. D. Seymour, S. W. Silver, W. Smyth, Sir H. C. Verney, Bart., and Major C. W. Wilson; Treasurer, R. T. Cocks.

ASIATIC SOCIETY.

JUNE 22ND.—J. Fergusson Esq., V.P., in the chair.—Sir G Campbell, Col H. L Thuillier, and Capt. H F. Blair were elected Members. A paper by Mr. Henry H Howorth, "On the Origines of the Manchus," was also read. Starting from various etymologies assigned to the word Manchu by several scholars, the writer examined the legendary accounts of the Manchus regarding their origin, and traced their history from the earliest times down to the death of Tai-tsu in A.D. 1625.

GEOLOGICAL SOCIETY

JUNE 10TH.—J. Evans, Esq., President, in the chair. Messrs H. Leonard, A Dunlop, and J Young, were elected Fellows.—The following communications were read.—"On the occurrence of Thanet-Beds and of Crag at Sudbury, Suffolk," by Mr. W Whitaker. "Notes on the Phenomena of the Quaternary Period in the Isle of Portland and around Weymouth," by Mr. J. Prestwich. "On the Character of the Diamantiferous Rock of South Africa," by Prof. N. S. Maskelyne and Dr. Flight. "Note on a modified Form of *Dinosaurian ilium*, hitherto reputed Scapula, indicative of a new Genus, or possibly of a new order of Reptiles," by Mr. J. W. Hulke; and "Note on a Reptilian Tibia and Humerus (probably of Hylæosaurus), from the Wealden Formation in the Isle of Wight," by Mr. J. W. Hulke.

CHEMICAL SOCIETY.

JUNE 18TH.—Prof Frankland, V.P., in the chair.—The following papers and memoirs were read:—"On the Action of Chlorine, Bromine, &c., on Isodinaphthyl," by Mr W. Smith, Communications from the Laboratory of the London Institution: No. XIII., "On Coal-Tar Cresol, and some Derivatives of Paracresol," by Dr. H. E. Armstrong and Mr. C. L. Field; No XIV., "On the Action of the Chlorides of the Acids of the Sulphur Series on Organic Compounds," by Dr. H. E. Armstrong and Mr. W. H Pike; No XV., "On Chloro-bromo and Iodo nitro Phenol-parasulphonic Acids," by Dr. H. E. Armstrong and Mr F. D. Brown; and No. XVI., "Note on the Decomposition of Dichloronitrophenol by Heat," by Dr. H. E. Armstrong and Mr. F. D. Brown,—"On the Products of the Decomposition of Castor Oil, No. III., on Decomposition by Excess of Alkaline Hydrate," by Mr. E. Neison. The author said he had succeeded in elucidating the conflicting statements of the different chemists on this subject "On Hydrogen Persulphide," by Dr. W. Ramsay, "Suberone," by Dr. C. Schorlemmer and Mr. R. S. Dale, "On the Action of Nitrosyl Chloride on Organic Bodies, Part I., on Phenol," by Dr. W. A. Tilden, "An Apparatus for Determining the Moisture and Carbonic Anhydride in the Atmosphere," "A Method for Determining Ozone in the Presence of Chlorine and Nitric Oxide," and "On the Constitution of Urea," by Dr. D. Tommasi, "On the Restitution of Burnt Steel," by Mr. S. L. Davis, "On the Action of Earth on Organic Nitrogen," by Mr. E. C. Stanford, "Aniline and its Homologues in Coal-Tar Oils," by Mr. W. Smith.

METEOROLOGICAL SOCIETY.

JUNE 17TH.—Dr. R. J. Mann, President in the chair.—Messrs. R. Bushell, T. Crawford, G. Gardiner, R. Smith, J. H. Steward, and E. Tremlow were elected fellows; Prof. Buys Ballot, Herr W. H. von Freeden, Dr. C. Jelinek, G. T. Kingston, M.A., Dr. J. von Lamont, Prof. E. Loomis, Dr. H. Mohn, Dr. G. Neumayer, Dr. E. Plantamour, M. C. Sainte-Claire-Deville, Padre A. Secchi, and Dr. H. Wild, were elected honorary Members.—"On the Connexion between Colliery Explosions and Weather in the Year 1872," by Messrs. R. H. Scott and W. Galloway. The paper is in continuation of those by the same authors read before the Royal Society in 1872, and before the Meteorological Society in 1873, which contained the results for the four preceding years. The number of fatal explosions which occurred during the year was seventy, causing the loss of 163 lives. Three of these killed, each of them, more than ten men, being the same as the average number of serious explosions for the last twenty years. The number of non-fatal explosions was 224. A comparison of the dates of all recorded explosions with the curves of the barometer and thermometer kept at Stonyhurst for the Meteorological Office leads to the following result. 58 per cent of the explosions are due to changes of pressure, 17 per cent. to great heat of the weather, while 25 per cent are not attributed by the authors to meteorological agencies. These proportions are nearly the same as those which have come out from the discussions of similar facts for previous years. The next question touched upon was the alleged greater prevalence of explosions with certain winds, and it was shown that the ordinary changes of pressure and temperature in the windrose were hardly sufficient to account for the explosions which are found to accompany sudden changes of weather. The paper also discussed a diagram exhibiting the continuous curve of barometrical pressure from the Glasgow Observatory for the last nine months of 1873, and a curve showing the prevalence of fire-damp in the mines of the West of Scotland district for the period. The books of thirty-five mines about Glasgow have been used for the comparison The two curves show a remarkable accordance in their course. The result shows that the escape of fire-damp is related mainly to the conditions of atmospherical pressure, and that a careful watch over the barometer is, above all, necessary in each colliery, though one such record would suffice for several adjacent mines.—"Solar Radiation, 1869-74," by the Rev. F. W. Stow, M.A.—"The Diurnal Inequalities of the Barometer and Thermometer, as illustrated by the Synchronous Observations made during May, 1872, at the Summit and Base of Mount Washington, New Hampshire, at the respective Heights of 2,615 and 6,283 feet above the Sea Level," by Mr. W. W. Rundell. The hourly mean differences of pressure and temperature at these stations and at Portland, Maine, the nearest U.S. station to Mount Washington, were discussed, and their most probable coefficients were determined, also the times at which their maxima and minima occur Upward and downward currents of air and vapour produced each day by the action of the sun, joined to the evaporation and condensation of moisture, and the absorption and liberation of heat, were suggested as sufficient to explain the phenomena, without recourse to the unsupported hypothesis of an overflow of air at the top of the atmosphere, and an inward current of air at the

earth's surface. Observations obtained by means of captive balloons fitted with automatic apparatus for recording the details of an observatory below them were suggested as likely to afford more satisfactory data for the solution of this problem, and as being free from some of the objections which necessarily belong to mountain observations. —"On the Diurnal Variation of the Barometer at Zi-Ka-Wei, and mean Atmospheric Pressure and Temperature at Shanghai," by the Rev. A. M. Colombel, M.A.—"Weather Report for 1873, at Woosung, China," by Mr. C. D. Braysher.—"Note regarding a remarkable Hailstorm at Pietermaritzburg, Natal, on April 17th, 1874," by the Rev. J. D. La Touche.

STATISTICAL SOCIETY

JUNE 30TH.—Anniversary Meeting.—The following Fellows were elected as President, Council, and Officers for the year ensuing: President, W. A. Guy; Council, Earl of Airlie, Sir J. Anderson, General Sir G. Balfour, H. G. Bohn, T Brassey, S. Brown, E. Chadwick, H. Chubb, Hyde Clarke, L. H. Courtney, F. Galton, R. Giffen, F. H. Janson, H. Jeula, J. T. Hammick, F. Hendrick, J. Heywood, F Jourdan, H. R. Lack, Prof. Leone Levi, W. G. Lumley, R. B. Martin, Dr. F. J. Mouat, R. H. Patterson, F. Purdy, E. Seyd, T. Sopwith, Earl Stanhope, General R. Strachey, and W. Taylor; Treasurer, J. T. Hammick, Secretaries, Dr. F. J. Mouat, R. Giffen, and H. R. Lack; Foreign Secretary, Dr. F. J. Mouat.

LINNEAN SOCIETY.

JUNE 18TH.—Dr. G. J. Allman, President, in the chair. Mr E. Birchall, Dr J Leathem, and Mr. J. H. Lewis were elected Fellows. — Mr. D. Hanbury exhibited branches of olive in flower grown in the open air, and a specimen of *Rheum officinale* the true officinal rhubarb.—Dr. Hooker made a communication on the subject of some Indian Garcinias.—Prof. Thistleton-Dyer exhibited a young oak-plant with three cotyledons.—Mr. A W. Bennett exhibited drawings of the style, stigma, and pollen-grain of *Pringlea antiscorbutica*, illustrating its provisions for wind fertilization.—The following papers were read: "On the Resemblances between the Bones of Typical Living Reptiles and the Bones of other Animals," by Mr. H. G. Seeley.—"On the Auxemmeæ, a new Tribe of Cordiaceæ," by Mr J. Miers.—A Revision of the Sub-order Mimoseæ," by Mr. G. Bentham.—"On some Fungi collected by Dr. S. Kurz in Yomah, Pegu," by Mr. T. Currey,—and "Notes on the Letters from Danish and Norwegian Naturalists contained in the Linnean Correspondence," by Prof. J. C. Schiodte, of Copenhagen.

ANTHROPOLOGICAL INSTITUTE.

JUNE 23RD.—Prof. Busk, President, in the chair.—Mr. R. G. Haliburton was elected a member. Mr. R. Dunn read a paper "On Ethnic Psychology." The author dwelt on the importance of carefully studying the cerebral organization of the typical races as the only way of elucidating the psychological differences which exist among them. Notwithstanding the labours of Gratiolet in that field of inquiry, a vast deal remained to be done. A paper by Mr. R. Pennington was read "On the Relative Ages of Cremation and Contracted Burial in Derbyshire in the Neolithic and Bronze Ages." The object of the paper was to show that the impression that stone implements and contracted burial, bronze implements and cremation, are usually associated is quite erroneous, as tested by the results of barrow-opening in the Peak of Derbyshire. The researches of Messrs. Bateman and Carrington, on being tabulated, proved that. Of "finds" containing stone implements, 66 per cent. were cases of contracted burial, 34 per cent. were burnt. In the bronze, 58 per cent. were contracted, 38 per cent. were burnt. It was clear that those who deposited stone implements in the graves of their dead, and those who placed there articles of bronze, shared pretty equally the differences of custom in the interment of the body. So that out of 150 contracted interments, 50 per cent. were accompanied by stone only, 12 per cent. bronze; and out of 86 burnt cases, 46 per cent. afforded stone only, and 14 per cent. bronze. The conclusion was fully borne out by examination of the contents of each tumulus. Several instances were given as showing that the Neolithic and Bronze peoples alike used both modes of burial. If bronze was introduced by invaders, the aborigines must have held their own in the Peak mountains, and the Bronze and Neolithic peoples must there have intermingled both their blood and their customs. A paper, by Miss A W. Buckland, was read, "On Mythological Birds Ethnologically Considered." The paper commenced by indicating the process by which savage tribes in the stage of totemism afterwards exalted their tribal totems into gods, and went on to show that that early phase of religion could be clearly traced in ancient Egypt. Many legends from various countries were quoted to prove that birds were especially regarded as the abodes of departed spirits. The chief object of the author was to prove that, in tracing the bird-legends to their sources, valuable ethnological result might be obtained, and a clue afforded to the migrations of man in pre-historic times. The President took the opportunity, on the last ordinary meeting of the session, of announcing that the appeal of the council of the members at the anniversary had been so successful that the institute was now free from debt.

July 1st.—Special Meeting.—Prof. Busk, President, in the chair. Mr. J Cunningham was elected a Member.—Col. Lane Fox read a paper "On the Principles of Classification adopted in the Arrangement of his Anthropological Collection exhibited in the East London Museum." The paper contained three divisions, viz., Psychological, Ethnological, and Pre-historic.

APPLICATIONS FOR LETTERS PATENT.

(*Continued from page* 110.)

railway carriages.—W. R. Lake. Improved inhaling apparatus (com.)—F. Wigg Treating and preparing granular or finely divided ores for smelting.—C. H. Southall. Finishing the edges of the soles and heels of boots and shoes.—R. T. Newnham. Landaus or such like carriages.—J. W. Gibson, J. P. Kennedy, and A. Prior. Manufacture of tobacco and oil and apparatus employed therein.—P. M. Shanks. Production of raised surfaces or blocks for printing and the preparation of materials and the construction of apparatus employed therein (partly com.)—J. T. McNally Means for separating flour or meal from bran and other foreign matter.—J. H. Johnson. Spark arresters (com.)—A. Browne. Tongs for serving salad, asparagus, and other edibles (com.)—J. Vavasseur. Projectiles for ordnance.—R. D. Sanders. Construction and working of signals and breaks on railway trains, locking and unlocking the doors of railway carriages, and economising fuel in locomotive engines.—T. L. Joyce. Mode of and apparatus for effecting a reduction of temperature applicable to the generation of motive-power, and to the manufacture of ice (com.)—C. Muratori. Manufacture of artificial leather.—J. G. Tongue. Means employed for transmitting motion on railways (com.)—Sir F. C. Knowles, Bart. Means and method of preventing decay of wood and other ligneous fibres.

On May 1st.—1527 to 1547.—T. B. Bishop. Sewing machines and attachments therefor (partly com.)—A. M Fowler and R. Husband. Construction of privies and water-closets.—W. McAdam. Utilising waste products of chemical works for constructing bricks or blocks for building or analogous structural purposes.—G. J. Brine and T. Allen. Cisterns or cistern apparatus for discharging or flushing at intervals and preventing waste of water.—E. L. B. Geicke. Apparatus for regulating and measuring the flow of gas or other fluids (com.)—F. Wright. Apparatus for stoppering bottles for containing gaseous and aerated liquids.—L. J. Todd. Tramway locomotives, and in cars for the same.—W. H. M. Blews. Purifying the quinoidine of commerce (com.)—J. W. Broadbent. Apparatus for heating the feed water of the boilers of locomotive engines.—I. Bradley. Solid flanged metallic cartridge cases (com.)—G. F. Bruce and R. Steers. Screws and screw-drivers.—W. Bull. Flame kilns or ovens for baking or burning bricks or other goods, by means of continuous firing.—A. M. Clark. Looms for waving (com.)—G. Westinghouse, jun. Apparatus for working brakes and communicating signals on railway trains.—J. Payne and J. W. Freestone. Night lights.—J. H. Johnson. Looms (com.)—H. B. Wilsher. Apparatus for withdrawing beer or other liquids from casks or other vessels.—G. A. Crow. Machines and tools for shaping metals.—J. Stone. Manufacture of wrought iron, and furnaces and apparatus employed therein.—M. Heymann. Portable book-holder.—Sir F. C. Knowles, Bart. Preparation of peat for fuel, and appliances or apparatus for the purpose.

On May 2nd.—1548 to 1559.—W. Webster. Manufacture of balls to be used in the game of croquet or other games.—T. E. Gullent. Methods of constructing buildings, warehouses, and dwelling-houses to render them waterproof. Sir F. C. Knowles, Bart. Manufacture of gas for heating purposes.—A. Chamberlain and J. Smith. Manufacture of pattern or moulding plates used in making moulds for casting metals.—J. Challis. Machinery for thinning and hoeing turnips.—J. H. Redcliffe. Valve oil cans and machines for manufacturing them, which is applicable to cutting out of other same tin or sheet-iron vessels.—H. Wilde Machinery and apparatus for excavating coal and other minerals, and the mode of actuating such machinery. W. R. Lake. Anchors (com.)—W. R. Lake. Label or ticket for the manufacturers of cloth or clothing (com.)—E. Walker. Machinery for damping paper for printing purposes.—S. H. Daddow. Squibs, fuses, and matches for mining and blasting purposes (Complete specification).—A M. Clark. Apparatus for grappling submerged objects and taking soundings (com.)

On May 4th.—1560 to 1576.—W. A. Lyttle Process and apparatus for smelting iron.—H. A. Bonneville. Apparatus for drying up bagasse and other materials (com.)—C Brock. Process of decorating pottery and other fictile manufactures. J. Ward. Machinery for drawing and spinning cotton.—W R. Lake. Syrup jug or pitcher (com.)—R. Gotthell. Heated air motors (com.)—R. Gotthell. Explosive compound for blasting purposes (com.)—R. M. Lowne. Anemometers and other fluid meters.—W. Pinkerton. Apparatus for communicating or signalling between parts of railway trains.—W. Lancaster and E. Hollander. Construction of apparatus for sizing and dressing yarns, part of which is also applicable for starching and drying woven goods.—T. Skinner. Mode or process of etching on steel or iron or other metal or substance.—H. Phillips. Marine engine governors or speed-governing and regulating apparatus for the motors of steam ships and such like purposes.—H. Cherry. Condensers for steam pumping engines.—W. Mort. Preservation of food and other perishable substances (com.)—B. Brown Boilers for treating fibrous substances for the manufacture of paper.—W. Taylor. Sewing machines and shuttles for the same (partly com.)—T. J Smith. Manufacture of lace (com.)

On May 5th.—1577 to 1589.—W. Elsam. Eyelet (com.)—H. Wilcock Button.—W. E. Gedge. Traction engine or mechanical horse, which may also be used for working fixed or portable machines (com.)—W. I. Clayton. Fire escapes.—W Knowles. Shake willey—T. O. Jones. Manufacture of crystal handles and tops for umbrellas, sun-shades, and walking sticks, also applicable to riding whips.—T. Jackson. Recovery of sulphuric acid when combined with certain chemical products.—W. T. Sugg. Apparatus for regulating the supply of gas.—B. Laker. Heating apparatus.—D. Spill. Machinery or apparatus for propelling tramway cars and other vehicles upon rails and common roads or both alternately, also applicable for propelling boats and other floating

vessels.—J. H. Johnson Apparatus for indicating and registering or recording variations in pressure, weight, and temperature (com.)—R. H. Cowins. Railway signalling apparatus.—F Lenoir. Apparatus for carburetting gas.

On May 6th.—1590 to 1603.—J. B. Hamilton. Construction of musical instruments.—J. Jackson. Lubricant to be used in the preparing wool.—E. Priestman. Machinery for combing wool and other fibres.—H. Sawyer. Extension tables (com.)—F. Curtis. Manufacture of agricultural and other implements (com.)—A. Ara and M. Del-Bubba. Composition for preserving metals from oxydation.—J. Thornton and W. D. Thornton. Apparatus for dyeing in sections fibrous materials or striped goods.—E. G. Brewer. Looms for weaving and particularly the jacquard mechanism (com.)—S. Stead Means for preventing rust or corrosion of iron and other metals.—T. H. Rushton. Machinery for preparing cotton and other fibres.—W Gin- —J. H. Ivory. Horse-shoes.—A. James. Needles com.)—J. Booth. Heating vertical steam engine boilers.—F. Oldham Stoppering bottles.—J. McKay. Drilling apparatus—J C. Mewburn Machinery for cleaning yarns (com.)—J. G Tongue. Lining for horse collars, saddles, and other parts of harness (com)—W. R. Lake. Steam boilers and furnaces, and apparatus connected therewith (com.)—C. Kiches. Machines or apparatus for grinding and sharpening knives or cutters of reaping and mowing machines and other knives, cutters, tools, or instruments, being also applicable for various motive purposes—W. Mitchell. Apparatus for elevating agricultural and other produce, applicable also for shooting and filling sacks and for other purposes.

On April 16th.—1308 to 1322.—J. Haughton, T. Thompson, and S. Poll. Horse rakes.—J. Laird, jun, and W. Rutherford. Weaving bags, sacks, and tubular fabrics, and the adaptation or arrangement of mechanism employed therefor.—A. Dawson. Ornamenting work lace—W. Hood. Telegraph and signal posts, pilasters, boundary posts, mile posts, and standards for the support of machinery or other matters.—C. W. Siemens. Method of transmitting telegraphic signals by submarine or other insulated electric conductors and apparatus for that purpose (com.)—R. Gottheil. Appason. Marine and other engine governors, which are especially adapted to high and low pressure combined engines.—A. V. Newton. Preparation of caustic alkali packages (com.)—D. Fisher. Meters for measuring water and other fluids.—W. Manson. Reciprocating pistons by atmospheric pressure, obtained by the action of a piston in a separate cylinder, by which the air in said cylinder is forced alternately above and below the working piston, said improvement being applicable for driving hammers stamps, drills, and other percussive machinery. (Complete specification)

M. A. de Candolle was elected at a recent meeting of the Académie des Sciences as "un Associé Etranger," to replace the late Prof. Agassiz.

Mr. R. W. Atkinson, B.Sc., has been appointed Professor of Chemistry in the Imperial College at Yeddo. Mr. Atkinson was formerly a student at the Royal School of Mines, and has for some time past been assistant to Prof. Williamson, at University College.

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APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur-street, Charing Cross.

On May 7th.—1604 to 1622.—J. Roberts. Governing the speed of marine engines, or, in other words, a hydro-dynamic governor for marine engines.—J. Harvey. Close carriage on a pair of wheels so contrived as to be safe and of light draught.—W. C. Nangle. Paint or compound for coating metals, wood, and other substances.—A. Piver. Process of manufacturing alcohols by a methodical and endless manner with wines and fermented juices of any kind by means of new or improved apparatus suitably disposed for the purpose.—H. Deakell. Machinery for applying postage and other stamps to envelopes and other articles.—C. Courtois. Instruments or apparatus for clipping or shearing animals, particularly applicable to the shearing of sheep.—G. D. Abel. Construction of buildings, and materials employed therefor (com.)—W. Hart. Thread cutter.—J. G. Wilson. Utilising lithomarge, and apparatus for grinding it and other substances.—W. F. Savage. Apparatus for drilling manure and sowing wheat and other grain or seed.—A. V. Newton. Manufacture of soap (com.)—S. Marsden, jun. Fastening metallic hoops or bands employed in packing bales of goods.—J. M. Hyde. Furnaces for generating steam in marine and other boilers.—J. Edwards. Stopping bottles, jars, and such like vessels, and apparatus for filling bottles and vessels, such apparatus being specially adapted for filling same with aerated liquids.—T. Guddam. Machinery for separating the silk fibres from waste cocoons.—H. Frost. Fluid motors, applicable also to apparatus for obtaining motive-power and for pumps.—H. Malcolmson. Drawing-room or gallery [illegible].—J. Wilson. Steam boilers.—C. Catlow. Looms for weaving.

On May 8th.—1623 to 1636.—C. Gutbrod and H. A. Cowper. Regenerative hot-blast stoves for heating air, steam, and other gases.—S. Swadney. Apparatus for burning petroleum and other volatile oils and spirits.—[illegible] Hand dredger for sinking wells in foundations of bridges, and for other similar [illegible] D. Nicoll. Vessels for containing [illegible] other liquids.—J. T. Mitchell. [illegible] boring turnips.—E. P. H. V[illegible] facture of metallic compositions [illegible] phorus combined therewith [illegible] applicable for bearings and [illegible] machinery [illegible] (specification).—H. Maclland. [illegible] for raising and lowering [illegible]

liers, the same being applicable also for other purposes.—H Searle Wrappers or envelopes used in oil-cake making, and for extracting oil from oleaginous seeds.—J. M. B. Baker. Appliances to be adapted to railway carriage and other doors to prevent noise from slamming.—G Haseltine. Machinery for ornamenting and finishing buttons and other like articles (com.) (Complete specification)—D. M. C. Smyth. Feed-motions for sewing machines—A M Clark. Method of retouching photographic negatives and positives (com.)—G. W. Elliott Sewing machines.

On May 9th.—1636 to 1660.—C D Abel. Apparatus for separating the fibres of silk rags (com.) (Complete specification).—J. E. Lefebvre Works for lighting.—C. E. F. Pfeifer. Smoothing irons.—R Hempsted. Machinery or apparatus for cutting, slicing, and pulping turnips and other roots.—G Mann, C. Pollard, and P. B. Watt. Lithographic and letter-press printing machinery.—R. Hotting. Steam engines, chiefly designed for cranes, hoists, and elevators.—P G B. Westmacott. Machinery for working lock gates.—J Wilkinson. Apparatus for obtaining motive power by means of hydrostatic pressure. E. P. H. Vaughan. Mode of and apparatus for treating phosphates of lime (com.)—W. R Pape. Rifles and shot guns.—J O. Spong Apparatus for removing dirt from boots, shoes, and goloshes. B. Hunt. Steam injectors or ejectors (com.)—J. D. Moultray. Fastening the joints of fishing rods, gaff-hooks, and similar articles by means of a self-adjusting spring lock.—M. Brown-Westhead Manufacture of what are commonly called ladders for venetian blinds.—I Frankenburg. Waterproofing and preparing leather.—W. Wilson and J Battersby. Chaff-cutting machines, &c.—E. Butterworth Air and gas engines.—R Steers and G F Druce Manufacture of horse shoes.—E T Bowden. Apparatus to be used in growing or training hop plants and fruit trees.—J. Butterworth and W. Dickinson Looms for weaving.—W. R Lake. Method of and mechanism for the transmission of motion in machinery (com.) D Greig and R. H Shaw Construction of machinery for the cultivation of land by steam power.—D Greig and R Burton. Tramway carriages when propelled by steam or other motive power.—P G B Westmacott Lock gates and caissons.—F. Curtis Method of sewing, and machine for executing the same

On May 11th.—1661 to 1676.—F. H. Oeles and J Woodcock. Reducing the frictional resistance to the movements of slide valves.—G. Luce. Improvement in process of and apparatus for de livering and refining lead.—J. Steedman. Purifying oils and other liquid or solid compounds of carbon.—M. Henry. Preparing or treating straw, jute, and other materials for the manufacture of paper or paper pulp (com.)—T. Kendrick. Ornamentation of coffin furniture.—J. Clark. Railway breaks, and means for operating the same.—W. R. Lake. Registering ticket punches (com.)—C. Beck. Apparatus for registering and indicating times and amounts at billiards and other similar games.—A. Hogg. Apparatus for indicating the speed of engines and their shafts, and registering the revolutions of same, which may also be applied as a speed regulator or governor.—J. M. Stuart. Gaseliers and glass shades or globes for gas-burners (com.)—E Cook and J. Bombroffs. Clay mills.—J. H. Johnson. Production of caustic alkalies and of carbonic acid (com.)—S. D. Caldwell. Torpedo boats or vessels, and the modes of propelling and controlling the same (com.)—M. Rau. Production of bituminous mastic or cement to be used in the paving of streets, formation of roads and railways, foundations of buildings, and for other purposes.—G. Dingley. Apparatus for regulating or controlling combustion in the furnaces of steam-boilers having internal flues.—A. M. Clark. Machinery for forging metals, and for other purposes (com.)

On May 12th.—1677 to 1693.—J. H. Johnson. Portable forges or furnaces and blowing apparatus (com.)—W. E. Gedge. Knife or instrument for cutting and shaping boot and other laces or thongs (com.)—E. A. Cowper. Process and apparatus for clearing and smoothing spun silk, yarn, and other like threads. P. Jensen. Furnaces (com.)—J. J. Richardson. Machinery for pointing wire used in the manufacture of needles, pins, card and hackle teeth, and for other purposes.—A. Field. Manufacture of mould candles, and in apparatus therefor (partly com.)—W. Hunt. Manufacture of wrought iron.—W. A. Camp. Telegraphic signalling apparatus.—J. B. Hamilton. Construction of musical instruments formed by combining reeds and strings. J. Aston. Sewing-machines.—J. Pollak. Treating yolk of egg in order to preserve it and prepare it for edible and culinary purposes (com.)—M. H. Cowell. Printing or devicing of cards, by which games for amusements can be played.—G. Alsing. Manufacture of an artificial fuel from sewage deposits, night soil, and other dry and moist manurial matters mixed with other materials. H. Potter. System of bleaching, and the apparatus employed therein.—J. T. Sands. Means of and apparatus for locomotion, applicable to cabs, carriages, and other light or heavy vehicles, also to tram cars and railway purposes.—A Browne. Process of separating the tin from scraps or cuttings of tinned or terne plates, or from old tinned articles.

On May 13th.—1693 to 1705.—N. Twiggs. Mills used for cleaning rice and other grains.—A. Clark Apparatus for cooling and delivering ale, beer, and other liquids for drinking (com.)—A. T. Gibson. Cleats and chocks (com.)—R. Cox Machinery or apparatus for sawing stone, and marble, and granite, or similar materials.—F. Holtermann. Cases for jewelry, watches, and other articles.—W. J. Warner and W. Cowan. Gas meters.—A. C. Thorpe and A. W Young. Construction of breast pin stem, which will securely retain its position in the scarf or other article.—W R Lake. Improved cotton bale-tie (com.)—P Mesck. Method of and means for the production of boxes and other hollow articles from paper pulp (partly com.)—F Cox Attaching door handles to their spindles.—M Picken and W. Picken Vices.—T. A. W. Clarke and R F. Donisthorpe. Weaving and craping hair for the manufacture of chignons, wigs, and such-like, and machinery to be used for this purpose.—A M. Clark. Manufacture of beer (com.)

On May 14th.—1706 to 1719.—A. Lohren. Machinery for combing wool, cotton, silk, flax, and other fibrous substances.—H. J. Kennard. Sand pumps or dredgers, and means of working same.—J F Hammond. Photographic albums.—A. Rudenberg. Meters for measuring the flow of liquids (com.)—J Kight and G. W. Mohrstadt. Sewing machines.—J Beale. Engine to be used for pumping gases, air, or fluids.—J. McCool. Sockets to receive the ends of telegraphs and other posts or uprights, and apparatus to be employed in lowering the posts or uprights into and withdrawing them from their sockets.—W. N. Raines. Pistons for steam-engines, pumps, and other such applications when packing is required.—J. Macintosh. Boring and sawing rocks and other mineral substances and dressing stone.—T. Hyatt. Constructing, lighting, ventilating, and fireproofing buildings, partly applicable to building materials and appliances to the furniture or "moveables" of buildings and to ships.—B. Hunt. Pianos (com.)—F. C. Backer. Boots and pumphlets, so as to adapt them for domestic uses.—J. H. Johnson Mechanism of and mode of supporting rock-drilling machines (com.)—A. de Beaurey. Furnaces and appliances connected therewith for the economical combustion of fuel.

On May 15th.—1720 to 1730.—J. Weems. Machine for purposes of recreation.—R. Murray and J. Paterson Apparatus for preventing the fire and explosion sometimes caused by the over friction and heat in grinding or crushing grain in flour, meal, and malt mills, from spreading with the "stive" or flour dust into the interior of the buildings or mills, and their receiving and dressing or air-exhausting chambers.—J. R. F. L[illegible]. Obtaining motive power, and the machinery or apparatus to be employed therein.—J. Reynolds and W. Reynolds. Machine for the speedy filling of bottles, tubes, jars, pots, and other utensils with ale, beer, sauces, vinegar, paints and inks, wines and spirits, chutney, and other liquid or semi-liquid substances, and for corking or stopping the same.—J Darlington. [illegible] engines.—J. Barrett and J. P. [illegible] method or means for preserving the interior parts of steam boilers.—W. Dawes and H. P. Holt. Machinery for cutting metallic [illegible].—S. Schofield. Domestic fireplaces.—W. Dawes and H. P. Holt. Steam [illegible].—[illegible] Construction [illegible] machine puddling, [illegible] heating furnaces.—W. R. Lake. [illegible]

for [illegible] clothes (com.) (Complete specification.)—W. R. Lake. [illegible] (com.)—F. G. Underhay. Apparatus for drawing off water to prevent or reduce waste.—E. A. Pontifex. Apparatus to be used in drawing off water and other liquors.—E. H. Hugh. Preserving blood for use as food.—H. A. Chapin. Spinning machinery.—J. H. Johnson. Manufacture and refining of sugar (com.)

On May 16th.—1737 to 1751.—H. Allen and M. Fitzpatrick. Apparatus for deadening the shock arising from collisions on railways, parts of which are also applicable for the protection of ships of war and for other similar purposes.—J. H. Greathead. Constructing tubular tunnels or subways, and apparatus for that purpose.—W. Garred. Attaching or connecting handles to coffins, drawers, and other articles.—J. H. Johnson. Steam-engines (com.)—T. S. Hunter. Excavating machines.—E. Kluge and J. Henderson. Obtaining sulphate of soda or of potash, hydrochloric acid, and chlorine.—R. N. Angus and W. H. Hammersley. Piston and pump rods, and glands for the same.—W. G. Stretton. Bookbinding, and means or apparatus to be employed therein.—H. J. Barr. Automatic signals, more especially adapted for use on railways where the "block" system of signalling is employed.—G. Lowry. Breaks for railway and other carriages.—J. Neale. Fastenings for carriage lamps.—F. Ripley and C. C. Seton. Machinery for spinning and doubling fibres.—C. J. Ball. Apparatus for compressing air or other elastic fluids.—T. Chambers. Agricultural implements.—K. E. Farrant. Preparation of finishing starch, and the finishing of dyed woven fabrics.

On May 18th.—1752 to 1763.—P. D. Hedderwick. Blast furnaces, and the manner of working the same.—C. A. H. Lindemann, M.D. Means to be employed for preserving every kind of animal and vegetable matter.—A. W. G. Weeks, G. Deal, G. Lillywhite, and A. O. Launder. Hot-water boilers and hot-water apparatus, applicable to the circulation of hot-water, part of which applicable to other purposes.—J. Salmon. Machinery for cutting and scoring cardboard, straw-board, millboard, and other similar substances.—S. M. Smith and C. T. Smith. Dyeing or printing textile or other fabrics, warps, or yarns, and machinery or apparatus to be employed therein.—J. Archer. Machinery for the manufacture of screw bolts and other like articles.—J. H. Johnson. Toy pistol and explosives for the same (com.)—J. Shawcross. Condensing carding engines for preparing cotton or cotton waste, or those substances mixed with other fibres for spinning.—A. M. Clark. Apparatus for suspending crockery ware in kilns for burning (com.)—R. L Jones. Railway points or switches.—J. J. Laveissiere. Refining and purifying of metals other than iron.—W. L. Wise. Manufacture of artificial stone (com.)

On May 19th.—1764 to 1783.—J. H. Kidd. Preparation and application of certain materials for deodorising sewage, nightsoil, and like matters, and the manufacture of artificial manures.—C. Bennett. Lamps.—M. Bustam. Means and apparatus for jointing and tightening wires, such as are employed for fences, telegraphs, and other purposes.—T. B. Jordan. Steam hammers, mineral-stamps, rock-drills, and other engines for obtaining rapidly repeated blows by the agency of steam or other elastic fluids.—J. Hartley. Construction of [illegible] settling vats, store vats, and [illegible] used by brewers, rectifiers, British wine makers, and others.—J. Phillips. Means of ventilating rooms, buildings, and other spaces.—J. T. Y. Hald. Mode of preserving milk and cream (com.)—J. W[illegible]. [illegible] apparatus for indicating the revolutions of steam engines and other machinery in motion.—E. P. [illegible]wood. Moulds for casting steel or other metal ingots.—T. R. Allen. [illegible]

(Continued on page 123.)

THE BRITISH A[illegible]

[illegible] in a paper by [illegible] of Birds, [illegible] the Conditions [illegible] they can soar [illegible] her mentioned [illegible] d taking with [illegible] few one out at [illegible] it sank as if [illegible] at a height

The forty-fourth annual meeting of the British Association commenced on August 19th, at Belfast, under its president, Professor Tyndall, F.R.S. Many of its leading members attended upon the occasion, including Sir John Lubbock, Bart., M.P., Professor Odling, Professor Huxley, Professor Hull; whilst there were also present the Earl of Enniskillen, the Earl of Rosse, Sir R. Wallace, the Rev. Dr. Henry, President of the Queen's College, Belfast; the Provost of Trinity College, Dublin; Professor Stokes, together with other gentlemen distinguished in science and literature. The place selected for the meeting was the Queen's College, situated in one of the most beautiful suburbs of Belfast, within easy access to the city.

Professor TYNDALL, F.R.S., commenced by tracing the scientific knowledge of natural phenomena from its development in the earliest times known to us—beginning with its anthropomorphic form to that period when it was placed upon a worthy basis, viz., when the doctrine of atoms, molecules, and Democritus was reached. He then followed this doctrine through the labours of the prominent figures connected with its introduction, remarking, as regards Epicurus, that his philosophy was almost identical with that of Democritus, but he never quoted either friend or foe. One main object of Epicurus was to free the world from superstition and the fear of death. Death he treated with indifference. It merely robs us of sensation. As long as we are, death is not; and when death is, we are not. Life has no more evil for him who has made up his mind that it is no evil not to live. He adored the gods, but not in the ordinary fashion. The idea of divine power properly purified, he thought, an elevating one, still he taught "Not he is godless who rejects the gods of the crowd, but rather he who accepts them." The gods were to him eternal and immortal beings whose blessedness excluded every thought of care or of occupation of any kind. Nature pursues her course in accordance with everlasting laws, the gods never interfering. They haunt—

> "The lucid interspace of world and world,
> Where never creeps a cloud or moves a wind,
> Nor ever falls the least white star of snow,
> Nor ever lowest roll of thunder moans,
> Nor sound of human sorrow mounts to mar
> Their sacred everlasting calm."

Lange considers the relation of Epicurus to the gods [illegible]—the indication, probably, of an ethical requirement of his own nature. [illegible]

[illegible] ton, Boyle, and their successors, which the chemical law of multiple proportions enabled Dalton to confer upon it an entirely new significance. What these atoms, self moved and self-posited, can and cannot accomplish in relation to life, is at the present moment the subject of profound scientific thought. Professor Tyndall then made mention of Bishop Butler, and the views entertained by him in his celebrated "Analogy of Religion," contrasting them with those advocated by Lucretius, by introducing an imaginary argument between the Bishop and a Lucretian disciple, the Professor's audience being supposed to be the umpire of the contest. The vast additions to scientific thought since Bishop Butler's time were then commented on, and the astounding revelations of geology referred to. This led the Professor up to a consideration of the theories propounded by Mr. Darwin in the "Origin of Species" and "Natural Selection," and expounded with such clearness by Mr. Huxley, who was described as having swept the curve of discussion through the really significant points of the subject, enriching his exposition with profound original remarks and reflections, often summing up in a single pithy sentence an argument which a less compact mind would have spread over pages. In our day great generalisations have been reached, and the theory of the origin of species is but one of them. Another is the doctrine of the conservation of energy, that doctrine exacting from every antecedent its equivalent consequent, from every consequent its equivalent antecedent, and laying vital as well as physical phenomena under that law of causal connection which may be said to assert itself everywhere in nature. Long ago the constancy and indestructibility of matter had been affirmed, and the latter quality was later extended to force. The idea applied to inorganic thus embraced organic nature. The vegetable world was proved incompetent to generate anew either matter or force, and the animal equally uncreative. The activity of each animal was shown to be the transferred activities of its molecules—the muscles' stores of mechanical force, potential until unlocked by the nerves, and the speed at which messages fly along these to and fro less than that of an eagle on the wing. This was the work of the physicist; then came the conquests of the comparative anatomist and physiologist, revealing the structure of every animal, and the function of every organ in the whole biological series, from the lowest zoophyte up to man. The nervous system had been made the object of profound and continued study, the wonderful power which it exercises over the whole organism, physical and mental, being recognised more and more. Thought could not be kept back from a subject so profoundly suggestive. Besides the physical life dealt with by Mr. Darwin, there is a psychical life presenting similar gradation, and asking equally for a solution. With the mass of materials furnished by the physicist and physiologist in his hands, Mr. Herbert Spencer, twenty years ago, sought to graft upon this basis a system of psychology, and, two years ago, a second and greatly amplified edition of his work appeared. Mr. Spencer's fundamental principle is, that, between the creature and the medium in which it lives, there is incessant interaction. The organism is played upon by the environment, and is modified to meet the requirements of the environment. [illegible]

of a few months sometimes slightly differ from the results previously found, and he said that these changes were probably the result of alterations of the unsoldered connections of the conducting wires; but whatever their cause they were probably met with in actual practice [illegible] the pyrometers were used during long periods of time. Professor Dewar said that as a chemist who had taken considerable interest in the determination by [illegible] justments, special portions [illegible] become more responsive to stimuli [illegible] others. With the development of the [illegible] the adjustments between the organism and its environment gradually extend in space, in time, in speciality and complexity, passing through the various grades of brute life and prolonging themselves into the domain of reason. Very striking are Mr. Spencer's remarks regarding the influence of the sense of touch upon the development of intelligence. This is, so to say, the mother-tongue of all the senses, into which they must be translated to be of service to the organism. Hence its importance. It is a fact of supreme importance that actions the performance of which at first requires even painful effort and deliberation may by habit be rendered automatic; and, combined with the doctrine of hereditary transmission, we reach a theory of instinct. A chick, after coming out of the egg, balances itself correctly, runs about, picks up food, thus showing that it possesses a power directing its movements to definite ends. In its inherited organisation are registered all the powers which it displays at birth. So also as regards the instinct of the hive-bee; and man carries with him the physical texture of his ancestry, as well as the inherited intellect bound up with it. By myriad blows (to use a Lucretian phrase) the image and superscription of the external world are stamped as states of consciousness upon the organism, the depth of the impression depending upon the number of the blows. When two or more phenomena occur in the environment invariably together, they are stamped to the same depth or to the same relief, and indissolubly connected. "If there exist certain external relations which are experienced by all organisms at all instants of their waking lives—relations which are absolutely constant and universal—there will be established answering internal relations that are absolutely constant and universal. Such relations we have in those of space and time. As the substratum of all other relations of the non-ego,* they must be responded to by conceptions that are the substrata of all other relations in the ego. Being the constant and infinitely repeated elements of thought, they must become the automatic elements of thought—the elements of thought which it is impossible to get rid of—the 'forms of intuition.'" Throughout this application and extension of the "Law of Inseparable Association," Mr. Spencer stands on totally different ground from Mr. John Stuart Mill, invoking the registered experiences of the race instead of the experiences of the individual. His overthrow of Mr. Mill's restriction of experience is, I think, complete. The learned Professor then went on to say as follows:—The origination of life is a point lightly touched upon, if at all, by Mr. Darwin and Mr. Spencer. Diminishing gradually the number of progenitors Mr. Darwin comes at length to one "primordial form," but he does not say, as far as I remember, how he supposes this form to have been introduced. He quotes with satisfaction the words of a celebrated author and divine, who had "gradually learnt to see that it is just as noble a conception of the Deity to believe He created a few original forms, capable of self-development into other and needful forms, as to believe that He required a fresh act of creation to supply the voids caused by the action of His laws." What Mr. Darwin thinks of this view of the introduction of life I do not know. Whether he does or does not introduce his "primordial [illegible]

liers, the same being applicable also for other purposes. —H. Searle. Wrappers or envelopes used in oilcake making, and for extracting oil from oleaginous seeds.—J. M. B. Baker. Appliances to be adapted to railway carriage and other doors to prevent noise from slamming. —G. Haseltine. Machinery for ornamenting and finishing buttons and other like articles (com.) (Complete specification).—D. M. C. Smyth. Feed-motion, &c., is certainly associated with the creation of a few forms as with the creation of a multitude. We need clearness and thoroughness here. Two courses, and two only are possible. Either let us open our doors freely to the conception of creative acts, or, abandoning them, let us radically change our notions of matter. If we look at matter as pictured by Democritus, and as defined for generations in our scientific text-books, the absolute impossibility of any form of life coming out of it would be sufficient to render any other hypothesis preferable; but the definitions of matter given in our text-books were intended to cover its purely physical and mechanical properties. And, taught as we have been to regard these definitions as complete, we naturally and rightly reject the monstrous notion that out of such matter any form of life could possibly arise. But are the definitions complete? Everything depends on the answer to be given to this question. Trace the line of life backwards, and see it approaching more and more to what we call the purely physical condition. We reach at length those organisms which I have compared to drops of oil suspended in a mixture of alcohol and water. We reach the *protogenes* of Haeckel, in which we have "a type distinguishable from a fragment of albumen only by its finely granular character." Can we pause here? We break a magnet and find two poles in each of its fragments. We continue the process of breaking; but, however small the parts, each carries with it, though enfeebled, the polarity of the whole. And when we can break no longer, we prolong the intellectual vision to the polar molecules. Are we not urged to do something similar in the case of life? Is there not a temptation to close to some extent with Lucretius when he affirms that "nature is seen to do all things spontaneously of herself without the meddling of the gods?" or with Bruno, when he declares that matter is not "that mere empty capacity which philosophers have pictured her to be, but the universal mother who brings forth all things as the fruit of her own womb?" The questions here raised are inevitable. They are approaching us with accelerated speed; and it is not a matter of indifference whether they are introduced with reverence or irreverence. Abandoning all disguise, the confession that I feel bound to make before you is that I prolong the vision backward across the boundary of the experimental evidence, and discern in that matter, which we in our ignorance—and notwithstanding our professed reverence for its Creator—have hitherto covered with opprobrium, the promise and potency of every form and quality of life. Professor Tyndall then proceeded to state that with Mr Spencer, as with the uneducated man, there is no doubt or question as to the existence of an external world. But he differs from the uneducated, who think that the world really is what consciousness represents it to be. Our states of consciousness are mere symbols of an outside entity which produces them and determines the order of their succession, but the real nature of which we can never know. The whole process of evolution is the manifestation of a power absolutely inscrutable to the intellect of man. The strength of the doctrine of evolution consists, not in an experimental demonstration (for the subject is hardly accessible to this mode of proof), but in its general harmony with the method of nature as hitherto known. Further, the doctrine of evolution derives man, in his totality, from the interaction of organism and environment through countless ages past.

mould candles, &c. com.)—W. H. understanding, for example—iron.—W. A. which Mr. Spencer has turned apparatus.—J. and upon its own antecedents musical instru... result of the play between and strings. ... environment through cosmic Pollak. Tr... ne. It is a result of the play of serve it and ... and environment that sugar is sweet and that aloes are bitter, that the smell of henbane differs from the perfume of a rose. There are such things woven into the texture of man as the feeling of awe, reverence, wonder, and the love of the beautiful, physical and moral, in nature, poetry, and art. There is also that deep-set feeling which, since the earliest dawn of history, and probably for ages prior to all history, incorporated itself in the religions of the world. You who have escaped from these religions into the high and dry light of the understanding may deride them; but in so doing you deride accidents of form merely, and fail to touch the immovable basis of the religious sentiment in the emotional nature of man. To yield this sentiment reasonable satisfaction is the problem of problems at the present hour. And grotesque in relation to scientific culture as many of the religions of the world have been and are—dangerous, nay, destructive, to the dearest privileges of freemen as some of them undoubtedly have been, and would, if they could, be again—it will be wise to recognise them as the forms of a force, mischievous, if permitted to intrude on the region of knowledge, over which it holds no command, but capable of being guided by liberal thought to noble issues in the region of emotion, which is its proper sphere. It is vain to oppose this force with a view to its extirpation. What we should oppose, to the death if necessary, is every attempt to found upon this elemental bias of man's nature a system which should exercise despotic sway over his intellect. The impregnable position of science may be described in a few words. All religious theories, schemes, and systems, which embrace notions of cosmogony, or which otherwise reach into its domain, must, in so far as they do this, submit to the control of science, and relinquish all thought of controlling it. Acting otherwise proved disastrous in the past, and it is simply fatuous to-day. It has been said that science divorces itself from literature, the statement, like so many others, arises from lack of knowledge. A glance at the less technical writings of its leaders—of its Helmholtz, its Huxley, and its Du Bois-Reymond—would show what breadth of literary culture they command. Science desires isolation, but freely combines with every effort towards the bettering of man's estate. I have touched on debatable questions, and led you over dangerous ground—and this partly with the view of telling you, and through you the world, that as regards these questions science claims unrestricted right of search. It is not to the point to say that the views of Lucretius and Bruno, of Darwin and Spencer, may be wrong. I concede the possibility, deeming it indeed certain that these views will undergo modification. But the point is, that, whether right or wrong, we claim the freedom to discuss them. The ground which they cover is scientific ground; and the right claimed is one made good through tribulation and anguish, inflicted and endured in darker times than ours, but resulting in the immortal victories which science has won for the human race. I would set forth equally the inexorable advance of man's understanding in the path of knowledge, and unquenchable claims of his emotional nature which the understanding can never satisfy. The world embraces not only a Newton, but a Shakespeare; not only a Boyle, but a Raphael; not only a Kant, but a Beethoven; not only a Darwin, but a Carlyle. Not in each of these, but in all, is human nature whole. They are not opposed, but supplementary; not mutually exclusive, but reconcilable. And if, still unsatisfied, the human mind, with the yearning of a pilgrim for his distant home, will turn to the mystery from which it has emerged, seeking so to fashion it as to give unity to thought and faith, so long as this is done not only without intolerance or bigotry of any kind, but with the enlightened recognition that ultimate fixity of conception is here unattainable, and that each succeeding age must be held free to fashion the mystery in accordance with its own needs, then, in opposition to all the restrictions of Materialism, I would affirm this to be a field for the noblest exercise of what, in contrast with the knowing faculties, may be called the creative faculties of man. Here, however, I must quit a theme too great for me to handle, but which will be handled by the loftiest minds ages after you and I, like streaks of morning cloud, shall have melted into the infinite azure of the past.

The learned professor resumed his seat amidst loud cheers. During the delivery of the address he was frequently interrupted by applause. A vote of thanks, on the motion of the Mayor of Belfast, was carried unanimously.

AUGUST 20.

SECTION A. — MATHEMATICAL AND PHYSICAL SCIENCE.

The Rev. Professor J. H. Jellett, M.A., M.R.I.A., President of the Section, presided. After some general observations, Professor Jellett went on to state that he would confine attention to the inquiry, What indications on this subject are presented by the actual progress of physical science? Does its history exhibit a tendency to widen or contract the field of mathematical analysis? Passing over sciences like astronomy, which, though not wholly free from hypothesis, do not give us very extended information on this point, he said, I come to a part of scientific history to which we may put the question with every probability of obtaining (so far, at least, as one science is concerned) a decisive answer—I mean, the history of physical optics. We have here a science whose basis is purely hypothetical. The definition of light is an hypothesis, the nature of the ethereal motion is an hypothesis, even the very existence of the ether is an hypothesis—hypotheses, indeed, which have led to conclusions amply verified by experiment, but hypotheses still. Does the history of optical science indicate a desire to discard the hypothetical base? Commencing with Fresnel, more than half a century ago, the history of physical optics is a history of efforts, constantly repeated, to frame what M. de St. Venant has called "a really rational theory of light." The Professor passed to the consideration of another branch of science, closely connected with, and indeed including, physical optics, and exemplifying, even more strongly, the desire of scientific men to extend the sway of mathematics over physical science — by which he meant molecular mechanics; and, amongst other important remarks, said the logic of molecular dynamics may be shortly stated as follows:—In seeking to form the equations of motion of a body, solid or fluid, we commence by an imaginary division of the body into elements of any arbitrary magnitude, and we form the equations of motion for each of these elements considered as a unit. The results so obtained are true, but, as long as the elements retain a finite magnitude, incomplete. They do not give us full information as to the movements of the system. But suppose now, adopting the spirit of differential calculus, that the magnitude of these elements is constantly diminished; then it will be found that, as in the differential calculus, these equations tend towards a certain limiting form, constantly approaching it as the magnitude of the elements is continually diminished; and in this limiting form these equations are not only true but complete. Stated in this general form, the principles of molecular dynamics are not only perfectly logical, but wholly free from hypothesis. Molecular

dynamics may be fairly called the differential calculus of physical science. Time will only allow me to notice very briefly another important application of mathematics to a branch of science considered hitherto to be altogether beyond the limits of our section. I refer to the application of the methods of geometry and theoretical mechanics in biological science recently made by Professor Haughton. The first example which I shall notice is the establishment of a principle governing the animal frame, and quite analogous to the principle of "least action" in dynamics. We have put to scientific history the important question—Is it probable that the dominion of mathematics over physical science will be more widely extended than it at present is? And to this question I think that scientific history must answer, Yes, it is probable. In concluding his speech the Professor said: —Another generation may learn to obliterate as completely the line between the domain of the chemist and the domain of the mathematician. When that shall be, when science shall have subjected all natural phenomena to the laws of theoretical mechanics, when she shall be able to predict the result of every combination as unerringly as Hamilton predicted conical refraction or Adams revealed to us the existence of Neptune—that we cannot say. That day may never come, and it is certainly far in the dim future. We may not anticipate it—we may not even call it possible. But not the less are we bound to look to that day, and to labour for it as the crowning triumph of science, when theoretical mechanics shall be recognised as the key to every physical enigma—the chart for every traveller through the dark infinite of Nature.

Dr. Huggins gave an account of some experiments he had made on Coggia's comet which was so striking an object in the northern sky a few weeks ago, with the spectroscope.

Professor Curtis read a paper on "Extraordinary Reflection," and exhibited an apparatus for verifying his theoretical results.

Professor F. Guthrie next read his papers "On a New Class of Hydrates." In the course of his remarks, he said, by reducing the temperature of a saturated solution of a salt (in water), it is possible always to remove such an amount of any anhydrous salt (or hydrate rich in salt) that the residue solution acts as a whole, that is, crystallises at a constant temperature and of a constant composition. The temperature at which this uniformity of composition is attained appears to be lower according as the hydrate is richer in water. Professor Stokes suggested that as the proposition between the salt and the water at which the whole solidified was determined by physical considerations, the number of equivalents of water to one of the salt would probably be fractional or incommensurable, which would violate the usual conditions of crystallisation; but that these would be maintained if we supposed two different hydrates to crystallise out simultaneously.

Mr. P. Brahats read a paper on "Further Experiments on Light with Circularly Ruled Plates of Glass."

Professor G. C. Foster offered suggestions for a re-determination of the absolute electro-magnetic units of resistance and electro-motive force. Professor Andrews described the methods of his experiments at high pressure, which gave rise to a discussion, in which part was taken by Professor James Thomson, Professor Maxwell, and Professor A. W. Williamson. The ex-President of the Association expressed his sense of the value of Dr. Andrews' experiments, and the importance to the physical world that they should be continued. During this discussion the attendance at the Section largely increased.

Mr. J. Dewar followed with a paper on a cognate subject—viz., "Latent Heat of Liquefied Gases."

A discussion also arose upon a paper by Professor Guthrie, "On the Flight of Birds, especially with reference to the Conditions of Atmosphere under which they can soar and hover." Professor Glaisher mentioned that, ascending in a balloon and taking with him a number of birds, he threw one out at a height of three miles, when it sank as if unable to float in the air, while at a height of four or five miles other birds which he tried to send out would not leave the balloon, but clung to him.

SECTION B.—CHEMICAL SCIENCE.

This Section met in the Chemistry Class-room, Queen's College. The President (Dr. A. Crum Brown) opened the proceedings by an address on chemical constitution. He first pointed out that the phlogistic controversy, which resulted from the discovery of oxygen, terminated in the total defeat of the phlogististe and the entire destruction of their theory. The issue of the next great chemical controversy, that between the dualistic theory of Berzelius and the substitution theory of Dumas, Laurent, and Gerhardt, was very different. Some historical writers argue as if here also the new doctrine had superseded the old, but the speaker maintained, as a more correct view of what really took place, that each theory underwent independent development, and inasmuch as both were sound, though imperfect, this development has now brought them very nearly to the same point. He illustrated this statement by an examination of the views of Berzelius as to the constitution of acetic and trichloracetic acid, and the constitution of ternary compounds, and showed how the difficulties involved in some of these cases were cleared up by the discovery of the multequivalent character of the atoms of certain elements. Dr. C. Brown defined chemical constitution as the order in which the constituents are united in the compound, and pointed out that the study of chemical changes (combination and decomposition) cannot lead us to a knowledge of the relative position of the atoms. But such a knowledge is required before a real theory of chemistry can be attained, and a knowledge of the intimate structure of matter may be looked for from an examination of the physical properties of substances and comparison of these with their chemical constitution. This, he maintained, is truly a branch of chemistry, and the greatest progress in it has been made by chemists, as may be proved by reference to the work of Faraday, of Graham, and of Andrews. By pursuing this branch, discoveries may be made which will lead to a hypothesis directly connecting chemistry with dynamics, and enabling us to apply mathematics directly to chemistry. The theory of chemistry will then be a particular case of the theory of dynamics. Such a result must be expected by all who believe in the progress of human knowledge, and in the consistency of Nature.

Professor G. C. Foster read a report of the committee on "Siemen's Electrical Pyrometer," which was composed of Professor A. W. Williamson, Professor Sir William Thompson, Professor Clarke Maxwell, and Professor Foster. In this report the committee continued their former reports as to the degree of accuracy which could be attained by the use of this instrument. After a description of the instrument, the committee reported that it was found that changes of resistance amounting to ·001·0 h m. up to 10,000 of the quantity of heat to be measured could be detected without much difficulty. They then developed a mathematical formula for the connections to be applied in making observations with the instrument, and concluded by stating that a comparison of the results given proved that the repeated measurement of the same pyrometer without intermediate heating after gave almost identical results if they were made within a few days of each other, but that measurements made after an interval of a few months sometimes slightly differed from the results previously found, and they said that these changes were probably the result of alterations of the unsoldered connections of the conducting wires; but whatever their cause they were probably met with in actual practice if the pyrometers were used during long periods of time. Professor Dewar said, that as a chemist who had taken considerable interest in the determination by high temperature, and in getting at some satisfactory means of registration, he felt, and he was sure, all chemists engaged in physical chemistry would read with pleasure this reiteration of the information communicated last year by Professor Foster. (Applause.) By this they would overcome any difficulties that prevented them from determining specific heats at high temperature. Any other instrument than that mentioned in the address was extremely laborious, and to get satisfactory results took a much longer time. The President said they should certainly thank Professor Foster and the committee for the very laborious series of investigations they had made in this matter.

Professor Roscoe read the report of the committee for superintending the monthly reports on chemical progress.

Mr. W. Chandler Roberts read the joint report of Dr. Wright, Dr. Gladstone, and himself on the chemical and optical properties of essential oils.

Dr. Hodges read the report on chemical composition of jute fibre.

Dr. C. Brown delivered a lengthened and learned address on the subject of mithyle thetine.

On opium derivatives Dr. R. C. Wright next delivered an address.

SECTION C.—GEOLOGY.

President, Professor Edward Hull, M.A., F.R.S., F.G.S.

A matter of interest in this section arose out of the report of the Committee for the Utilisation of Sewage. Professor Corfield read a report which stated that the Committee had been unable, from want of funds, to prosecute their inquiries as fully as they could have desired, but a member of the Association, feeling the importance of the subject, had promised the funds that were necessary to carry on the inquiry. Professor A. Williamson stated that the ground upon which the experiment was being conducted (Breton's Farm, near Romford) was originally composed of 60 per cent. of flint stones and 30 per cent. of sand, the remainder including traces of several kinds of soil. It had been proved that after three or four years of treatment with nitrogen the soil had become considerably enriched. It was arranged that the Committee should be reappointed.

A number of papers were read, most of which related to geological discoveries in Ireland.

Reports were also given in regarding cavern explorations. One of these was submitted by Mr. Pengelly, the Secretary of the Committee for exploring Kent's Cavern, Torquay. The report represented that the investigation had been pursued since the meeting of the Association in Bradford, and the work had been most satisfactorily performed. It was mentioned that live rats continued from time to time to present themselves in the cavern, and proved very troublesome during the summer season. Bees were also frequently seen in the innermost branches of the cavern, far beyond any glimpse of light. The report described minutely the researches which had been prosecuted, and the section thanked the Committee for their exertions.

Mr. R. H. Tiddeman read a report by the Committee for assisting in the exploration of the Settle Caves. The attention of the explorers during the year had been given chiefly to the Victoria Cave, in which were found among the boulders a few bones, a very

large fragment of one of which appeared to be that of an elephant. In the Roman layer several bronze articles were discovered, and in other parts of the cave the explorers picked up many objects of interest, among them being glaciated stones. It was also mentioned that in 1872 a human bone was found at a depth of 20ft. from the surface of the lower cave earth, and about six yards from the boulders. In the course of a brief conversation which followed the reading of the report, Professor Harkness, Professor Geikie, and other members of the section expressed a desire that the investigation of the Committee should be continued, as they believed some interesting and important information was likely to be derived. The Committee were thanked for their work, and instructed to continue their explorations.

Professor A. Nicholson, M.D., D.Sc., F.R.S.E., Professor of Geology in the Royal College of Science, Dublin, read a paper on "A Remarkable Fragment of Silicified Wood," from the Rocky Mountains. He said the specimen which formed the subject of the present communication was brought by the late Mr. John Worthington, of Toronto, from the well-known "petrified forest" of Colorado. The petrified forest was a place familiar to, and much visited by, tourists. All round the area were placed numerous erect stumps of silicified trees, most of which were three or four feet in height, and from ten to twenty feet in diameter. These phenomena would strongly support the belief that those ancient trees grew upon the margin of a lake which has now disappeared. Professor Harkness said he was present at Brighton last year when this same specimen was exhibited. He was then under the impression that it was a piece of mineral rock, but, after hearing Mr. Nicholson's exhaustive paper, he had no hesitation in changing his opinion, and now believed it to be silicified wood. Rev. Dr. Macloskey, W. Pengelly, and the Chairman having made some observations, the thanks of the meeting were given to Professor Nicholson for his valuable communication.

Professor Nicholson also read four other papers on the following subjects:—Description of new species of *Cystiphyllum* from the devonian rocks of North America. Description of species of *Alecto* and *Hippothoa* from the lower silurian of Ohio, with a description of *Aulopora arachnoidea*. Description of new *Polyzoa* from the lower and upper silurian rocks of North America. On *Fenestella stellata* and *Fenestella calceana*, with notes on the affinities of *Fenestella* and allied genera.

SECTION D.—BIOLOGY.

Professor Redfern, M.D., president of the Biological Section, delivered the opening address. The Section then separated into its three departments.

In the Anatomy and Physiology Department, the President, Professor Redfern, read a paper on "The Influence of Good Food and the Method of Supplying It to Plants and Animals." Of the latter part of the subject, he said there were few problems of more importance than how they should acquaint the wives of labourers, artisans, and even the wives and servants of the middle-classes, how they should expend a fair share of their income on food to the greatest advantage, and how to prepare it without destroying its nutritious properties. He condemned the practice of mincing or cutting up meat into small blocks and then stewing it, the effect of which was that the albumen in the outer face of each block became firmly set, and the whole afforded about as indigestible a mass as could well be imagined. The process of salting fresh meat had the effect, he said, of abstracting the juices and hardening the fibre so as to destroy or greatly deteriorate its digestibility. To a change of diet, the substitution of what were called the finer kinds of food for the buttermilk, oatmeal porridge, and bacon and beans formerly in use, his friend Dr. Gordon attributed the fact that the peasantry in the county of Down were not able to do the same amount of work as formerly, and that the athletic exercises in which they had formerly indulged had fallen into disuse.

In the Department of Anthropology, Sir George Campbell delivered an address on "The Peoples between India and China":—Among one of the tribes, he said, the wife was the head of the household. She courted and proposed to the man, and after marriage took the responsibility of providing for the family. She lived in her own house and on her own estate, and descent was on the female side. (Laughter.)

SECTION E.—GEOGRAPHY.

The Geographical Section met in the library of the Presbyterian College, under the presidency of Major Wilson, R.E.

In this Section the first paper read was one by Mr. E. G. Ravenstein, F.R.G.S., F.S.G., giving a narrative of Dr. Nachtigall's explorations in Africa, 1869–74.

A cordial vote of thanks was awarded to Mr. Ravenstein.

The next paper to be taken up was one by Dr. S. Rowe, on "Sir John Glover's Expedition from the Volta to Coomassie." Major Wilson, president of the Section, introduced Dr. Rowe, who, he reminded the Section, was lately chief of the staff of Sir John Glover. Dr. Rowe then read his paper. Mr. Ball, after remarking that no one could fail to be satisfied with the great importance of Sir John Glover's expedition, adverted to the question of the duty of this country with reference to these African tribes. His own opinion was that a great country coming in contact with an uncivilized people had forced upon it duties from which it must not shrink if it would avoid the condemnation of posterity.

The President read extracts from a letter which he had received that evening from Colonel Gordon, who wrote from the River Lobat on the 26th of June. The communication showed that the writer was taking energetic steps to put an end to the slave trade in that region.

The other papers read in this Section were extracts from Lieutenant Cameron's journal with reference to the East African expedition, and a paper by Dr. G. Schweinfurth, on the oases of the Lybian Desert. Dr. Schweinfurt afterwards made a few remarks in German expressive of the pleasure which he experienced in visiting Britain, which was recognized as the home of exact geography and science, and in which earnest scientific inquiry had not been lessened by commercial prosperity. Votes of thanks were awarded the authors of papers. The Section then adjourned.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

The Right Hon. Lord O'Hagan, President.

The first paper read was by Sir George Campbell, K.G., on "The Privileges over Land, wrongly called Property," in which he remarked:—The divorce of the people from the land, which was daily rendered more complete by the enclosure of commons and the strict assertion of rights of property, must lead to revolution. The only way he saw to a popular tenure of land was the growth of tenant-right. On Conservative grounds that should be fostered.

After Sir G. Campbell had concluded his paper, Lord O'Hagan observed that the next paper to be read was on the Ulster Tenant Right by Professor Donnell. Professor Donnell proceeded to read his paper, which gave a minute and ample history and exposition of Tenant Right, and stated a variety of considerations which recommended it socially and economically.

Mr. D. Henderson also read a paper on the statistics of the Irish Land Act, showing that the Ulster Tenantry had got more than the tenantry of other Provinces, but what they had was more uncertain. There had been 768 cases connected with the operation of the Act in Ulster, while there had been only 660 cases tried throughout the rest of Ireland.

The other papers read were "Scheme of Technical Education for those Interested in Land," by the Rev. W. Western Wood; "Teaching of Hygiene in Government Schools" by Dr. R. Coton; "On the Adjustment of Punishment to the Causes of Crime," and "Postal Reform," by Mr. W. Hastings.

SECTION G.—MECHANICAL SCIENCE.

President, Professor James Thomson, F.R.S.E., who opened the proceedings by delivering his address. After mentioning that he had chosen to speak of those matters which, through their novelty or their important progress in recent times would be most interesting, he proceeded to consider the various subjects of railway accidents, including the block system; deep sea soundings, signalling at sea, and house drainage.

A paper on "Water Power of the Upper Bann River," was read by Mr. John Smyth, jun., M.A., C.E.

Mr. George F. Deacon, C.E., read a paper descriptive of the Differentiative Waste Water Meter, one of which was exhibited in full operation. He said that the primary object of the waste water meter was to draw a diagram showing in gallons per hour the rate of flow through it for every instant during any day and night.

A paper on "Coal Mining in Italy" by Mr. P. Le Neve Foster, jun., C.E., was read by Mr Foster, sen. The writer dealt with the coal fields which were situated in the Tuscan Maremma, which, he said, appeared to have their origin in the middle Tertiary series.

Mr. William Bottomley read a paper describing the eclipsing apparatus at Holywood Lighthouses. The Belfast Harbour Commissioners, the author of the paper stated, had adopted the apparatus for the improvement of the light on the Holywood Bank. At present there was a red light fixed on the Bank, but it was liable to be mistaken for the red or port light of a vessel. The apparatus, which was designed by Sir William Thomson, and constructed by Mr. James White, Glasgow, for the Belfast Commissioners, was an improvement of the plan proposed by Charles Babbage, shown in the Exhibition of 1869. Sir William's proposal was that each lighthouse should exhibit from sunset to sunrise a definite series of eclipses, representing one of the letters known in telegraphy as the Morse alphabet; an experimental trial of the apparatus on the lighthouse had been made with very satisfactory results, and in a few weeks it would be in permanent operation. Mr. Bottomley believed that the success of the plan would direct public attention to this simple means of rectifying the defects in our present lighthouse system, and would lead to the adoption of it or some similar method for distinguishing lighthouses along the United Kingdom.

TWO new species of fungi, from the neighbourhood of Kazan, in Russia, have been described by Herr N. Sorokin, in the "Botanische Zeitung." These organisms are of interest as representing new types, closely allied to Chytridia. The author proposes to include these types in a special natural group, to be described under the name of Siphomycetes.

DR. JOUSSET DE BELLESME has lately made a special study of the poison secreted by the scorpion, and has conducted a series of experiments showing its physiological action upon the blood. These experiments are recorded in an "Essai sur le Venin du Scorpion," published in the "Annales des Sciences Naturelles."

Reviews.

SULPHUR IN ICELAND.

"Sulphur in Iceland." By C. CARTER BLAKE, Doct. Sci., Hon. For. Sec. Lond. Anth. Soc. London: E. and F. N Spon, 48, Charing-cross. 1874.

THIS is a work of advocacy, favouring the *exploitation*, as our French friends would say of the sulphur supplies to be obtained in a certain part of Iceland. It is a pleasantly-written pamphlet, and affords a good deal of interesting information on what is, without doubt, a subject of great industrial importance.

We select the following as an interesting sample of the work:—

The very language of Iceland seems to indicate the importance of its sulphur deposit It is a significant fact that the Icelandic language indicates sulphur as the "burning stone" *brennisteinr*, unlike the Danish *svovel*, which is obviously derived from sulphur, Lat. So a sulphur mine is called *brennisteinsnámar* in Icelandic, but in Danish *svovlgrube*.

Mr. Vincent's theory, that sulphur is produced by the action of water on pyrites, though having some elements of probability in it, is nevertheless entirely unproven in the present state of science, and it is most unfortunate that throughout his paper theory and fact are mingled in equal proportions, each being independent of the other. "*Tant pis pour les faits.*"

It was left for Captain Burton to point out that the testimony of Commander Commerell, which appears in Mr. Vincent's paper to make the transit from Krisuvik to Hafnarfjordr a real path of roses, did not actually speak with such unqualified enthusiasm. Commander Commerell says·

"A tramway might also be laid down, but as there are two hills to cross with other difficulties, I could not positively state whether this were possible or not"

Another objection by Captain Burton appears to be of greater force. It is alleged that the Krisuvik deposits extend over an area of twenty five miles No precise geological map is given of the locality, and it is most significant that when Captain Burton and Mr. Chapman rode from Krisas Bay eastward to the Little Geyser, and although they looked anxiously for the enormous area theoretically assigned to the sulphur formation, they failed to see any sign of it. The sulphur, like the Spanish fleet, was not in sight, and the absence of the palagonite, which is invariably in other Icelandic localities found in juxtaposition with the sulphur, ought to hint to geologists the true state of the case.

Further on our author states —These considerations, which have been so well urged by Captain Burton, are sufficient amply to demonstrate that there exists at Myvatn an enormous supply of sulphur for the use of the European colonist.

The Danish Government were not slow to perceive this, and have on numerous occasions endeavoured to attract attention to the value of their mineral products. Mr Lock, an Englishman, some years ago petitioned the Danish Government, and expressed his wish to take a lease of the sulphur mines at Myvatn. A committee was elected by the Icelandic Althing to report upon this subject. This report, which is dated the 14th August, 1869, exhibits the utmost timidity in permitting an alien to acquire rights over the mineral products of Iceland.

It is argued :—

"That the inhabitants will not be able to benefit by this if the mines are made over to strangers, neither can it be controlled that they should not destroy the mines altogether, and render them completely useless, after a lapse of some years.

"The sulphur mining at Krisuvik has shown that these mines are better and richer than had been expected, and this may be the case, too, with the mines on the north, which have most frequently been deemed richer and more extensive than those of Krisuvik."

HOMŒOPATHY.

"The Influence of Homœopathy on General Medicine since the death of Hahnemann." By R. E. DUDGEON, M.D., Edin. Being the Presidential Address delivered at the Congress of British Members of the Medical Profession practising Homœopathy, held in London. June 4th, 1874 London· Henry Turner, and Co., 77, Fleet-street, E.C., and 41, Piccadilly, Manchester. 1874.

As advocates of the progress of original ideas, we deem it right to bring this pamphlet under the notice of our readers, because we are aware that the journals of medical science are, as a rule, likely to take it up with an unfavourable bias, as relating to a system antagonistic to that which they hold to be othodox

Whether homœopathy is all it claims to be or not, it is quite clear it is not a mere scheme of quackery as the allopaths allege Indeed, a main principle of homœopathy, namely, giving, for the cure of a disease, a medicine that has the power of producing a disease similar to the one to be cured,—in other words, a medicine that acts on the same parts or organs as the natural disease, appears to have been recommended in certain cases by Hippocrates, Asclepiades, Paracelsus, Stahl, and several others though Hahnemann, the founder of homœopathy, was the first who insisted that it was the general rule for the application of drugs to disease, and he showed how remedies of this sort could be discovered, viz by testing them in large doses on the healthy.

The review of the history of homœopathy commences by stating that up to the date of Hahnemann's death (1843) 31 years ago —it must be admitted that the effect of his doctrine and practice on the ordinary treatment of disease was inappreciable. The practice of medicine remained pretty much as it had been at the commencement of the present century The abstraction of blood in acute inflammatory disorders by leeches, cupping and venesection was regarded by most orthodox practitioners not only as allowable but as indispensable. The depleting treatment attained its climax in the *coup sur coup* venesections of the illustrious but sanguinary Bouillaud Purgation by the most drastic cathartics was regarded as the appropriate medication in almost every case. Mercurialization to the extent of salivation was still in vogue Counter irritation by blisters, rubefacients, issues, setons, and the actual cautery was in daily use Sudorifics, diuretics, emetics, and so-called alterative treatment were universally employed

If, now and then, the observation of a better result obtained by the followers of Hahnemann led a stray practitioner to express a doubt respecting the propriety of the ordinary depleting methods, his scepticism was resented by his orthodox colleagues and the crass humoralism that prevailed was irreconcilable with a method which professed to cure without the evacuation of any of the fluids of the body.

The great and learned Hufeland could not deny that brilliant cures were effected by the mild specifics of homœopathy; but, while admitting so much, he deprecated the adoption of this method, exclaiming that if it should prevail it would prove "the grave of science." It might be supposed that that science was scarcely worth keeping above ground which failed to cure patients as well as its unscientific rival.

In this country the eminent surgeon, Mr. Kingdon, gave mortal offence by extolling the anti-inflammatory virtues of aconite, which had been taught him by a disciple of Hahnemann. He predicted that the time would soon come when aconite would supersede venesection, and "our lancets would be allowed to rust in their cases." An outcry was raised at this heretical vaticination, and the medical periodical which takes its name from the maligned instrument poured all the vials of its wrath on the head of the rash author, who was fain to recant his heresy in order to escape more serious consequences. Since then lancets have everywhere been rusting in their cases to the unspeakable advantage of the patient-world.

The favourable, though limited, testimony to the success of homœopathic treatment given, with all candour, by the most eminent of modern surgeons, Mr Liston, fell upon unwilling ears. Liston was too great a man to be bullied, and too courageous and independent to be made to retract a well-considered opinion so he was let alone, and his testimony in favour of homœopathy quietly ignored

So, in spite of the occasional protest of some distinguished member of the dominant school, the practice of that school remained uninfluenced by Hahnemann's teaching up to the time of his death Every description of heroic practice (which, being interpreted, means violent interference with the normal processes) had its advocates The most perturbing methods were held by physicians to be—what they euphemistically termed—their "sheet anchors" in various affections. Thus in inflammatory diseases, bleeding was the sheet anchor of one set, tartar-emetic the sheet anchor of another, calomel the sheet anchor of a third, purgatives, sudorifics, vesicants, diuretics the sheet-anchors of as many other sets Other diseases had an equal or greater number of sheet anchors How such destructive processes ever came to be called "sheet-anchors" it would be hard to tell, or why "anchors" at all "torpedoes" seems a more appropriate name for them, as they were designed to blow the disease to bits but they just as often send the patient to the bottom

After this general review of the history of the subject, Dr Dudgeon dilates upon the hostility of the allopathic examining boards, being, as he says, converted into inquisitorial Star chambers and their diplomas denied to candidates suspected of homœopathic leanings or who refused to promise never to practise homœopathy Unworthy intrigues were set on foot to oust Henderson from his chairs of clinical medicine and pathology Distinguished physicians were summarily expelled from hospitals they had served with honour and success, because they sought to give their patients the benefit of homœopathic treatment Laws were passed by colleges and societies denouncing all who prescribed medicines according to the principle of similars as unworthy of association with those who prescribed differently A medical Bill was introduced into Parliament one main object of which was to put down what was called "irregular practice"—meaning thereby homœopathy This object was fortunately frustrated by the vigilance of the practitioners aimed at, but the design was not the less apparent Inquests held on the bodies of patients who had died under the care of homœopathic practitioners for they would occasionally be so perverse—resulted in the finding by jurors under the direction of medical coroners of verdicts of "manslaughter;" at least, in one notorious case this verdict was, by the direction of Coroner Wakley, the brilliant editor of the combatant *Lancet*, or rather, I should say, by that of his son and deputy, recorded against a practitioner whose own brother had died of Asiatic cholera while nominally under his care but not really so for when the case took an unfavourable turn the unfortunate practitioner was himself prostrated by an attack of cholera. It was, in truth, a glorious triumph of orthodox physic when the culprit was consigned to a cell in Newgate

to await his trial for his life, nominally for killing his brother, but actually for his therapeutic heresies. To relieve the minds of those of you who do not remember the facts of the case, I may mention that on this occasion the majesty of "crowner's quest law" was not vindicated by the culprit's ignominious death on the scaffold, but that he was speedily released by a grand jury, which thus showed itself devoid of all proper feeling for the maintenance of orthodoxy in medicine.

But in spite, says Dr. Dudgeon, of denunciations, persecutions, caricatures, calumnies, *suppressiones veri, suggestiones falsi*, and coroners' inquests, the practice we owe to the genius of Hahnemann gained daily in public estimation. In medical matters the public looks only to results, and this test applied to homœopathic practice showed it to be, in numerous cases, vastly more successful than the ordinary treatment.

The growing confidence of the patient-world in homœopathy, together with the brilliant successes obtained by the practice among their own circle of acquaintance, as well as in public hospitals—more particularly the Homœopathic Hospitals of Vienna, which were visited and reported on by delegates from their own body—gradually forced upon the dominant school a reconsideration of their own methods of treatment.

The whole practice of medicine was changed with remarkable rapidity. The mildest drugs were alone employed. Treatment became at once "restorative" and "supporting." Diseases were all weaknesses requiring strengthening treatment. Tonics, nutritious food, and alcohol in every form, as wine, stout, ale, and brandy, were the fashionable medicines.

The complete change that took place in pathological ideas no doubt helped to produce this revolution in medical practice. The investigations of physiologists and pathologists completely discredited the gross humoral pathology by which alone the treatment of disease by evacuants could be justified. The general acceptance of the doctrine of the dynamical nature of disease gave the death blow to all those monstrous forms of evacuant treatment which owed their origin to an antiquated materialistic pathology.

A sort of Œcumenical Council was held at the College of Physicians of Edinburgh, whose members issued a decree declaring that the medical faculty was now and had always been infallible and unchangeable, and that it was disease that had changed, not they. "Change of type of disease" was the shibboleth that was to reconcile the altered practice with the recognised infallibility of the faculty, that was to smooth all difficulties and efface all apparent inconsistencies.

This "change of type" notion was received with acclamation by medical writers and journalists, and at one time seemed on the point of being universally accepted as the true solution of the difficulty, and a ready method of accounting for the change of practice without admitting the influence of homœopathy in the matter.

The experience of Dietl in pneumonia, repeated as it was in many different quarters, and extended with like striking results to other inflammatory diseases, created an unduly favourable opinion of the expectant or do-nothing treatment of all diseases, and for a long time the leaders of medical opinion contended that all active medicinal treatment should be discarded, and that the sole duty of the physician should be to remove from the patient everything that was likely to interfere with the natural course of disease, to place him in the hygienic conditions most conducive to recovery, to attend to his diet and regimen, and to support his strength by generous food, and a more or less liberal use of alcoholic stimulants. In short, that the physician's chief duties should be a sort of combination of the offices of nurse and cook, and all medicinal interference was deprecated as being useless or even pernicious. In fact, medicine accurately corresponded to the sarcastic description of it given by Mephistophiles to the enquiring student, which we read in the first part of Goethe's *Faust*, and which I may freely paraphrase as follows:—

> The secret of med'cine is: Nature's vast forces
> You study in all their relations to man,
> And when you have done this, your only right course is
> To leave them to fight it out just as they can.

But it was impossible that such negative doctrines could obtain any wide-spread or permanent popularity among either the profession or the patient-world. The public naturally thought that the *raison d'être* of the physician was to cure, not merely to nurse disease. Medicines were justly held to be his curative instruments. The belief in the curative effects of medicines was too deeply implanted in men's minds to be annihilated in this fashion. Patients objected to having their diseases let alone. They had much faith in the remedial powers of drugs, and but little in those of nature, and they insisted on their doctors sharing their faith in physic. Some doctors who had lost their belief in medicines had acquired a firm persuasion of the remedial virtues of stimulants, and, under the leadership of the late Dr. Todd, a system of treatment by alcoholic preparations was carried on the consequences of which were in many cases most deplorable.

But it would seem that the medical profession is undergoing an unacknowledged process of conversion to homœopathy, for, Dr. Dudgeon continues, The pathology of modern times has been gradually coming into accord with the homœopathic therapeutics. And this, I take it, is a remarkable and unique phenomenon in the history of medicine, that the therapeutics in consonance with a pathological theory should have preceded the theory. It would not be far from the truth to say that the therapeutics in this case was the cause of the pathological theory. At all events, it is hard to imagine that the rational pathology of our times would ever have been invented or adopted by a race of believers in the virtues of bleeding and other evacuant treatment.

Hahnemann saw that the pathological theories of his time would not square with his therapeutics, so he was forced to reject them and substitute more appropriate pathological theories of his own. But Hahnemann though a good observer, was an indifferent theorist, and whilst his rule of treatment remains his pathological theories have, for the most part, fallen into oblivion.

Hufeland's prophecy has been fulfilled to a degree he little dreamt of, for homœopathy has proved "the grave of science"—of such science, pathological and therapeutical, as prevailed in his day, and could Hufeland see the state of medicine now-a-days, he would find the pathological theories and therapeutical methods he professed and practised all decently buried, and the master-spirits of medicine holding pathological views and pursuing pathological investigations in a way that must inevitably lead them, indeed, has already led them partially, to adopt therapeutical practices in the sense of the principle promulgated by the illustrious contributor of so many original articles to his *Journal*.

HISTORICAL EVIDENCE.

"The Rules of Evidence as Applicable to the Credibility of History." By William Forsyth, Q.C., LL.D., M.P. Being a Paper read before the Victoria Institute, or Philosophical Society of Great Britain, 2nd March, 1874. London: Robert Hardwicke, 192, Piccadilly; 1874.

This is a work well worthy of perusal, for in these days of almost universal scepticism it is truly a matter of importance, in many points of view, to be able to understand the grounds of one's belief in any matter which does not rest upon the evidence of our personal knowledge. No man is more competent to deal with this subject than Mr. Forsyth, and he has treated it with consummate ability; nevertheless, to our mind, he has, like most men, been unable to disburthen himself of views of what is true and right which have already become established in his mind. Lawyer like, Mr. Forsyth considers that whatever we do not see our way clear to disprove we are bound to believe. "For," says Mr. Forsyth, "to believe without any evidence at all is irrational; but to disbelieve against sufficient evidence is equally irrational. By sufficient evidence I mean such an amount of proof as satisfies an unprejudiced mind beyond all reasonable doubt. Mathematical truth alone admits of *demonstration*. All other kinds of truth can only be proved by probabilities, which vary in an almost infinite degree, from the faintest kind of presumption to what is called moral certainty, which is accepted as practically equivalent to demonstration." Now, although we are quite prepared to admit that it is irrational to refuse to decide and act upon probabilities when only probabilities are to be got at, and when decision and action are absolutely requisite, yet we cannot see there is anything irrational in suspending the judgment as it is termed, in cases where no such necessity exists, especially if a case presented to us be made up of probabilities and improbabilities, the latter being perchance in greater quantity than the former, as are most histories, whether profane or sacred, especially when their authentication rests on hearsay upon hearsay, so to speak, or upon documentary evidence of old world doings, with no sufficient warranty as to the proper character of such documents, *i.e.*, whether they are copies of copies or original productions, though not the earlier original productions most people suppose them to be copies of. Of course, if we are prepared to take for granted enough to form a sufficient basis, it is not very difficult to believe the superstructure to be stable and trustworthy. Mr. Forsyth, like most of the advocates of orthodoxy, cannot fully understand that there is a state of mind in which, although we cannot say we believe neither can we really say we disbelieve, and the intelligent investigator of history is usually in this frame of mind after considering all that can be said concerning its genuineness. When we find that a man can, in regard to circumstances occurring within one's own lifetime, create so much difficulty as the Claimant did in deciding whether he was the real Tichborne or only an Orton pretender, it is surely not irrational that after taking every pains to arrive at the truth of historical statements of very ancient date, we usually can do no more than pronounce them to be most probably true or very difficult to believe.

REVIEWS POSTPONED.

"The Royal Commission on Unseaworthy Ships, Examination of the Reports and Evidence of the Commission." By G. Howell.

"A Letter to the Duke of Somerset, Chairman of the Commission." By Samuel Plimsoll, M.P.

"Technical Training." By Thomas Twining, one of the Vice-Presidents of the Society of Arts. Macmillan and Co. 1874.

Mr. J. H. Foley, R.A., the eminent sculptor, died at his residence in London on Thursday, the 27th ult., in the [illegible] year of his age.

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THE INVENTORS' INSTITUTE.

ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON

ESTABLISHED 1ST MAY, 1862.

President of Council:

SIR ANTONIO BRADY.

TO MEMBERS OF COUNCIL.

uncil Meeting on Thursday, September 10th. Executive meeting at the same time.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, St. Martin's-place, S.W., who is the proper official to give re-·pts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

: the 6th August, 1874, a conference of the Executive (Com-ttee) of the Institute with certain Members of Parliament essrs. A. Macdonald, T. Burt, Crawley, Charley, and unington being invited to attend) and Messrs. Broadhurst, otterhead, G. Savage, T. Paterson, G. Howell, and others, as resenting working men's interests, was held at 4 St. Martin's-ace; SIR ANTONIO BRADY, President of the Council, in the air.

After the Secretary (Mr. F. W. Campin) had stated that the ect of the meeting was to bring about a concurrence of views l co-operation of action with the Inventors' Institute on the t of members of Parliament and representative working men regard to the amendment of the Patent Laws, which, as he lained by reference to correspondence with various members of present Government, was likely to be taken in hand for the t Session of Parliament:—Sir Antonio Brady remarked that object of the meeting, he need scarcely mention to those sent, was of the highest importance to our national welfare, ce success in industrial pursuits was the mainstay of this intry; nor need he dwell upon the importance of a cheap and cient Patent Law to members of the working classes, since all w very well that many of our ingenious workmen were entors, who complained loudly of the unjust operation of the sting Patent Laws, which practically forced the man of small ans into the hands of capitalists or large employers of labour be dealt with according to the pecuniary views of the latter.

Mr. G. SAVAGE quite concurred with Sir A. Brady in these narks, and added that from his own knowledge he could say it the public lost the benefit of many good inventions because a notion of improving any branch of industry entered a work-n's brains he often took no trouble to work it out, upon the und that he could get no adequate return for his ingenuity and able. And in some cases where working man inventors did work t their ideas in tangible models they frequently locked them up as rets which were eventually buried in their graves.

Mr. MOTTERSHEAD quite agreed with all that had been said that ning, but he would remark that what was wanted was that the estion of Patent Laws should be brought into activity as a estion of the day; and if that were to be the basis of any move-nt he would heartily join in it. He thought cheapness in tent Laws a *sine quâ non*.

Mr. CHARLEY, M.P., speaking as a member of the Legislature, ld only remark that he came to the meeting to learn how he ld be of service to the cause of Patent Law Amendment, and would give his best attention to any propositions the Institute ght lay before him.

[The other members of Parliament before mentioned made ilar promises.]

After some observations by Mr. A. J. MURRAY, Mr. CARTTAR, M. M. HARRIS, and Mr. MORGAN, SIR ANTONIO BRADY ved, Mr. HARRIS seconded, and it was carried unanimously, at a joint Committee to act in this matter of those present be pointed.

At the Executive Meeting on 27th August, a vote of con-lence with the family of the late Sir W. Fairbairn, Bart., a e-President of the Inventors' Institute, was passed, and the retary was ordered to prepare and forward a suitable notifica-n in writing thereof.

Monthly Notices.

Hygrometric qualities of woods have, by the researches of M. T. Du Moncel, found to be subject to variations corresponding with the variations in the humidity of the atmosphere at different times of the day, the maximum and minimum being a little before sunrise and a little before sunset respectively, even with woods which are to all appearance quite dry, and as electric conductivity has been found to have relation to humidity, these researches are worthy of note.

Dr. T. L. Phipson, with regard to sun sensitiveness of molybdate of ammonia dissolved in sulphuric acid, which forms a colourless solution, and is one of the best agents for determining the amount of chemical action in the sun's rays (this solution becoming blue by exposure to them, and becoming again colourless in the dark), repeats his recommendation made in the *Comptes Rendus* in 1863, of this solution in the *Chemical News*, as giving, he finds by renewed observations, more accurate results than any other.

Mr. James Lick, of San Francisco, has left to the State of California 700,000 dols., for the purpose of erecting and endowing an astronomical observatory, and furnishing it with "a powerful telescope, superior to, and more powerful than, any telescope ever yet made."

Detection of Poisonous Exhalation from Wall Papers.—Dr. Humberg, of Stockholm, has been investigating the constituents of the atmosphere in rooms with walls covered with papers which contain arsenical pigments. The results of these researches are published in a recent number of the *Pharmaceutical Journal*. The paper of the room in which the experiments were conducted had a light green ground, with an ornamental pattern of brownish-yellow colour; the yellow was probably derived from an ochre, but the green resembled Schweinfurt green, and was strongly arsenical. An arrangement was made for drawing a current of air through a series of U-shaped and bulbed tubes, suspended on the wall. The passage of air was continued from July 16 to August 16, 1873; and it was calculated that during this time about 2,160,000 cubic centimètres of air had traversed the system of tubes. Some of the tubes had been plugged with cotton-wool, whilst others contained a solution of nitrate of silver, and at the termination of the experiment the contents of the tubes were separately examined. The results showed that there had been an arsenical exhalation It is only fair to state that none of the family residing in the house suffered any marked injury to health, although Dr Humberg informs us that after sleeping in a room by the side of the department in which the experiments were made, and with the door open, he frequently experienced, on the following morning, a sense of heaviness in the head and a general feeling of weariness.

Death of M. le Comte Gustave Doulcet de Pontécoulant is announced, at his chateau, Pontécoulant (Calvados), on the 21st of July. His memoirs upon the great comet of Halley gave him a universal reputation. His mathematical papers led to his being named a Foreign Associate of our Royal Society and of the Royal Academy of Sciences of Belgium.

Paul Rosa.—We have also to announce the death, on the 11th of July, of this able assistant of Padre Secchi in the Astronomical Observatory of the Roman College. He has but just published, in the *Atti dell' Accademia Pontificia de' Nuovi Lincei*, a memoir, "Identité de la Période des Phénomènes Photosphériques et des Phénomènes Magnétiques en connexion avec le Mouvement Propre du Soleil."

Les Mondes for the 13th of August prints a good translation of Prof. Ramsay's "Physical History of the Rhine."

Oxidation of cinchonin, through the medium of nitric acid, has yielded to the researches of Dr. H. Weidel several new and peculiar derivatives. Four distinct acids have been prepared in this way, according to the strength of the nitric acid and the duration of its action on the alkaloid. These researches are described in the last number of the *Annalen der Chemie*.

Action of Alkalies and Oxidizing Agents upon Cotton Fibre.—According to M. Jeanmaire, if cotton upon being saturated with chromic acid, or chromate of potash and sulphuric acid, or with permanganate of potash, and subsequently washed, although the fibre presents no apparent change, it will be found to be seriously weakened when treated with an alkali. This cannot be too widely known by our calico-printers.

Ettringite, a mineral from Ettringen, near the Lake of Laach in the Eifel, has been described by Herr J. Lehmann as a new species. It is a hydrous sulphate of alumina and lime, to be so named. A new Mexican mineral, consisting of a double selenide of bismuth and zinc, has been described by Don A. del Castillo.

Professor Grant has been removed by death during the past month.

M. Coggia, to whom we owe the first detection of the principal comet of this year, and who is acquiring a great reputation in this department of astronomy, discovered at Marseilles another new comet (which will reckon as V., 1874) on the 19th inst., in the constellation Taurus. At present it appears to be small and faint—even more so than the comet recently discovered by Borelly, and is only visible in powerful telescopes.

The rejection of a paper from Section D (British Association), entitled "An Irenicum, or a Plea for Peace and Co-operation between Science and Theology," by the Rev. Prof. Watts, D.D., of the Assembly's College, Belfast, caused some excitement. Bills were posted in the town, announcing that this rejected paper would be read in Elmwood Church; and a large and sympathetic congregation was thus drawn together. However praiseworthy the writer's intentions might be, it is clear that as there is no Section for Theology, the only course open to the Committee was to reject such a communication, though it may be questioned whether, under these circumstances, the President ought to make theological speeches.

The Pine-tree Odour.—The fine odour of recently-felled and barked pine-trees in spring time will be familiar to most. In *Berichte der Deutschen Chemischen Gesellschaft zu Berlin*, Ferd. Tiemann and W. Haarmann, in a paper "On Coniferin, and its Conversion into the Aromatic Principle of Vanilla," show that the juice scraped from the recent bark yields by digestion coniferin which is at first inodorous, but which in the course of time acquires the odour of vanilla.

Uriah A. Boyden, of Boston, Mass., United States, has deposited with the Franklin Institute the sum of one thousand dollars, to be awarded as a premium to "any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

Mr. Charles J. Wister, in the *Journal of the Franklin Institute*, for July, has a paper "On the Moon's Figure as obtained in the Stereoscope," in which he shows that the oval or egg-shaped figure of the moon, as deduced from the calculations of the continental astronomer, Gussew, of Wilna, after stereoscopic examination, is an illusion connected with the principle of that instrument.

Researches in Acoustics, by Alfred M. Mayer, is a valuable contribution to the science of sound, which appears in the *American Journal of Science and Art* for August. In the same journal will be found two papers on analogous subjects, one by Prof. Ogden N. Rood, "On an Optical method of Studying the Vibrations of Solid Bodies," and "On the Phonautograph," by Mr. Charles A. Morey.

M. Alphonse de Candolle has just republished, from the *Archives des Sciences de la Bibliothèque Universelle de Genève*, in which it appeared in May last, the "Constitution dans le Règne Végétal de Groupes Physiologiques applicables à la Géographie Botanique, Ancienne et Moderne."

An elliptic orbit of the fine comet discovered by Coggia on April 17 (III., 1874) has been calculated by Schulhof, of Vienna, with the result of a period of 12,184 years. Of course this can only be considered provisional, and the definite determination will not be made until the observations in the southern hemisphere are published; but it is at least certain that the orbit is extremely eccentric. This comet must not be confounded with the small comet (VII., 1873) re-discovered by the same astronomer on the 10th of last November, which has a period of about 55 years.

In Symon's Monthly Meteorological Magazine, for July, there are translations of two papers by MM. E. Belgrand and G. Lemoine and by Prof. Raulin, "On the Water Supply of France in the Summer and Autumn of 1874." The former express their belief that, in all probability, "the watercourses and springs of the Seine will fall, between now and the middle of next October, to almost the lowest point yet observed." The Professor informs us that the dearth of water during the last six months appears to have extended over the whole plain of South-West France and to the Pyrenees. Since rainfall observations were commenced in 1714, similar drought has only occurred six times, viz., in 1750, 1768, 1781, 1864, and 1874. He also states that there is reason for believing "that in the Eastern part of England the supply of water in wells, ponds, and streams will be very deficient, although not quite to the same extent as in North-Eastern France."

Mr. Spottiswoode has resigned the position of Treasurer of the British Association, and Prof. A. W. Williamson, of University College, London, has been appointed his successor.

French Physical Observatory.—The question of the establishment, near Paris, of a Physical Observatory, independent of the Astronomical one, came before the Académie des Sciences at the Séance of the 10th of August. The President of the National Assembly directed that the members of the Academy of Sciences should form a commission, which should examine into and report on the purposes and advantages of such an establishment.

Capt. Campello, of the Portuguese Navy, has been appointed to proceed to London to represent Portugal at the International Conference for Maritime Meteorology which is about to be opened. As is known, this Conference was first proposed at the International Conference of Brussels in 1853, and preliminary discussions took place at Leipsig in 1872, and at the Vienna Congress in 1873. Capt. Campello knows English, and has already visited London on a scientific mission; he has made astronomy and meteorology his special studies, and has been for many years attached to the *personnel* of the Lisbon observatories. The selection made by the Portuguese Government seems altogether a good one.

Elements and ephemerides of the comet (IV., 1874) discovered by Borelly on July 25 have now been published, both by Mr. Hind and by Dr. Holetschek, of Vienna, but much success cannot be expected in seeing so faint an object during the present increasing moonlight. It appears that it will be in perihelion on August 27, about 69 millions of miles from the Sun, or a little less than the Earth's mean distance. It is now about 70 millions of miles from the Earth, increasing, and its apparent place in the [illegible].

Proceedings of Societies.

GEOGRAPHICAL SOCIETY.

JUNE 15TH.—General Sir H. Rawlinson, V.P., in the chair.—The following new Fellows were elected:—His Excellency Senhor Joao de Andrade Corvo, as Honorary Corresponding Member; Marquis of Lorne, Le Vicomte E. de S. St. Jean, Major-General Bentinck, Lieut.-Col. J. G. R. Forlong, Rev. R. Lewis, Messrs. A. Brent, S. B. Coxon, R. Gordon, G. Grantham, W. H. Huddleston, H. J. Jenkinson, R. M. Lawes, A. Robertson, R. B. Smith, and J. M. Sutton. The papers read were:—"A Month's Journey in Kokand in 1873," by Mr. E. Schuyler; and "Progress of Forsyth's Mission to Kashgar and Exploration of the Pamir Steppe," by Major-General Sir H. C. Rawlinson.

ENTOMOLOGICAL SOCIETY.

JUNE 1ST.—Sir S. S. Saunders, President, in the chair. Mr. A. Guénee was elected an Honorary Member, in the place of M. Guérin-Méneville, deceased. Mr. A. G. Ward was elected a Subscriber. Mr. M'Lachlan exhibited specimens of the white ant (Calotermes, sp.), recently bred at Kew, from a sample of the wood of the tree (*Trachylobium Hornemannianum*) that produces the gum copal of Zanzibar. Mr. Stainton read a letter from the Rev. P. H. Newnham, stating that he had taken two living specimens of *Deiopeia pulchella*, on the Cornish side of the river Tamar. Mr. Stainton remarked on the early period of the year when they were captured as being very unusual. Mr. C. O. Waterhouse sent for exhibition a living specimen of a mantid (*Empusa pauperata*), in the larva or pupa state, brought from Hyères, by the Rev. Mr. Sandes. He had tried to feed it with flies, but could not induce it to eat anything while he was looking on. Mr. Stainton remarked that it would probably have seized a live spider at once if it had been offered one. Mr. W. D. Gooch communicated a detailed account of his experiences with regard to the longicorn coffee borers of Natal. Dr. Horn (of Philadelphia) stated that European conifers, limes, &c., planted in a public park at Philadelphia, were all killed by the larvæ of native species, such as *Callidium antennatum* and *Monohammus dictator*, though apparently in a healthy condition, whilst the native trees were not perceptibly affected. He was inclined to believe that the insects attacked healthy trees; but Mr. M'Lachlan believed that, according to the observations of most European entomologists, the European species of longicorns did not attack living wood in a perfectly healthy state. Mr. Butler communicated a paper "On New Species and a New Genus of Diurnal Lepidoptera, in the Collection of Mr. Druce." Mr. Smith read a revision of the Hymenopterous genera Cleptes, Parnopes, Anthracias, Pyria, and Stilbum, with descriptions of new species of the genus Chrysis, from North China and Australia. The genus Anthracias was noticed as specially interesting, as it did not appear to have been recognised since Klug published his brief generic characters; but Mr. Smith had been able to recognise it from a specimen in the collection of the late Mr. Shuckard, where it had evidently been mistaken for an example of *Parnopes carnea*, which it closely resembled.

ZOOLOGICAL SOCIETY.

JUNE 16TH, 1874.—Dr. A. Günther, F.Z.S., V.P., in the chair. An extract was read from a letter received from Dr. A. B. Meyer, concerning two birds (*[illegible]* and *Gempsphaga [illegible]*) lately described in the society's "Proceedings" by Mr. Sclater. A letter was read from Mr. W. [illegible] relating to certain species of [illegible] found in Venezuela. Dr. J. [illegible] paper on the nature of the [illegible]

the hornbills, which he stated, in confirmation of Professor Flower's account of these objects, to consist of the epithelial lining of the stomach. Mr. W. Saville Kent, F.L.S., F.Z.S., communicated a second paper upon the gigantic cephalopods recently encountered off Newfoundland. From further information received, Mr. Saville Kent apprehended that it would be necessary to refer the two individuals preserved in St. John's Museum to the genus *Ommastrephes*, thus avoiding the institution of a new genus for their reception, as proposed in his former paper. Mr. A. H. Garrod read a paper on the "showing off" of the Australian bustard (*Eupodotis australis*) and pointed out the peculiar structures by which this "showing off" was accomplished. A communication was read from Dr. F. Stoliczka, containing a description of the *Ovis poli* of Blyth, of which he had lately obtained specimens in Yarkand. Mr. R. Bowdler Sharpe read a paper on a new genus and species of Passerine birds from the West Indies, which he proposed to name *Phaenicomanes iora*. A communication was read from the Rev. O. P. Cambridge, containing descriptions of some new species of spiders of the genus *Erigone* from North America. Dr. Günther read a paper describing some new species of reptiles from the Camaroon Mountains, West Africa. Amongst these were two new species of chameleon, and a new snake of the family of Lycodontidæ, proposed to be called *Bothrolycus ater*. One of these chameleons was referred to a new subgenus (*Rhampholeon*) being remarkable for its abbreviated tail and the development of a denticle at the inner base of each claw. Mr. Sclater read a paper containing a description of three new species of the genus *Synallaxis* from M. Jelski's collections in Central Peru, which he proposed to call *S. pudibunda*, *S. graminicola* and *S. virgata*. Messrs. H. P. Blackmore and E. R. Alston communicated a joint paper on the Arvicolidæ which have hitherto been found in a fossil state. Professor Newton read an account of a living dodo shipped for England in the year 1628, extracted from letters in possession of Dr. J. B. Wilmot, of Tonbridge Wells. Mr. J. E. Harting read a paper on the common lapwing of Chili, which he proposed to separate from *Vanellus cayennensis*, under the name *V. occidentalis*. A second paper read by Mr. Harting contained an account of the eggs of some new or little known Limicolæ. A communication was read from Mr. R. Swinhoe containing an account of a new cervine form discovered in the mountains near Ningpo, China, by Mr. A. Michie, and proposed to be called *Lophotragus michianus*. Dr. J. Murie read a paper on the structure of the skeleton of *Fregilupus varius*, based on a specimen in the Museum of Cambridge.

This meeting closed the present session. There will be no more scientific meetings until November next.

Communications intended for the scientific meetings of the Zoological Society of London, should be addressed to the secretary, P. L. Sclater, Esq., Hanover-square, London, W.

THE INSTITUTION OF CIVIL ENGINEERS.

The council of this society have just awarded the premiums and prizes, arising out of various trust funds, for papers read and discussed during the recent session. The annual awards are as follows:—1. A Telford medal, and a Telford premium, to Bindon Blood Stoney, M.A., M. Inst. C.E., for his paper "On the Construction of Harbours and Marine Works with Artificial Blocks of Large Size." 2. A Telford medal, and a Telford premium, to Richard Christopher Rapier, Assoc. Inst. C.E., for his paper "On the Fixed Signals of Railways." 3. A Telford medal, and a Telford premium, to [illegible] [illegible], F.R.S., Assoc. Inst. C.E., for his paper "On the [illegible] Conditions affecting the Construction of a Tunnel between England and France." 4. A Watt medal, and a Telford premium, to Alexander Carnegie Kirk, Assoc. Inst. C.E., for his paper "On the Mechanical Production of Cold." 5. A Watt medal, and a Telford premium, to George Wightwick Rendel, M. Inst. C.E., for his paper on "Gun Carriages and Mechanical Appliances for working Heavy Ordnance." 6. The Manby premium, to Leveson Francis Vernon-Harcourt, M.A., M. Inst. C.E., for his "Account of the Construction and Maintenance of the Harbour at Braye Bay, Alderney." 7. A Telford premium, to Major James Browne, R.E., Assoc. Inst. C.E., for his paper "On the Tracing and Construction of Roads in Mountainous Tropical Districts." 8. A Telford premium, to William Douglass, M. Inst. C.E., for his paper on "The Great Basses Lighthouse, Ceylon." 9. A Telford premium to Joseph McCarthy Meadows, for his paper on "Peat Fuel Machinery." The following prizes have likewise been awarded to students of the Institution:—1. A Miller prize to James Charles Inglis, Stud. Inst. C.E., for his paper on "Theory and Practice in the Construction of Tanks." 2. A Miller prize to Matthew Curry, jun., Stud. Inst. C.E., for his paper on "The Lisbon Steam Tramway." 3. A Miller prize to Walter Young Armstrong, Stud. Inst. C.E., for his paper "On the Construction of, and the means employed to place in Position, the Cylinders of a Bridge over the Wye, at Newport." 4. A Miller prize to Charles Graham Smith, Stud. Inst. C.E., for his paper on "Practical Ironwork." 5. A Miller prize to Alfred Fyson, Stud. Inst. C.E., for his paper on "Details in the Construction of Docks." 6. A Miller prize to George Edward Page, Stud. Inst., C.E., for his paper on "Coal Gas and its Manufacture."

PATENT OFFICE REPORTS.

In their annual report for the year 1873, the Commissioners of Patents show that the number of applications for letters patent was 4,294, but that the number of patents passed was only 2,974; while 2,906 specifications were filed, and 1,320 lapsed or were forfeited, as the applicants had neglected to proceed for their patents within the six months of protection, and 68 were rendered void by the failure of the patentees to file specifications. Between October 1, 1852, and December 31, 1866, the number of 29,807 patents were applied for, but the additional progressive stamp duty of £50 was paid at the end of the third year on only 8,372 patents, while 21,435 became void. The additional progressive duty of £100 was paid at the end of the seventh year on 2,891 of those on which the £50 duty had been paid, and 5,481 were dropped. Thus 72 per cent. of the three years' patents were not proceeded with, and 90 per cent. of the seven years' patents also became void. All patents and specifications have, however, been printed and published in some form, either complete or abridged, and a method has been adopted for their due classification, and for rendering them easily accessible for reference. Liberal arrangements also appear to have been made for opening this collection of patents, &c., to the public, not only in London, but in the provinces, and also in the colonies, and many foreign countries, and a long list of towns, learned societies, &c., to which copies of patents have been supplied, is published. It appears from the balance-sheet that during 1873 the sum of £144,751 12s. 8d. was received for stamp duties under the Act, while the expenditure has left a surplus of £[illegible] 1s. 10d.

MORE SCHOOL BOARD DESPOTISM.

According to the police reports in the daily press, several persons were on Thursday, [illegible] August, [illegible] by Mr. [illegible], the magistrate [illegible] [illegible] [illegible] Police-court, for not sending their children to a School Board school, although these children were sent to other schools. But as their high-mightinesses, the School Board officials, had not "recognised" these schools, whatever that may mean, the magistrate convicted these free-born Britons as evil-doers requiring punishment, and lectured one of the parents for entertaining the improper view that girls ought not to be whipped, thus practically [illegible] the little girl back again to the tender mercies of the whipping governess.

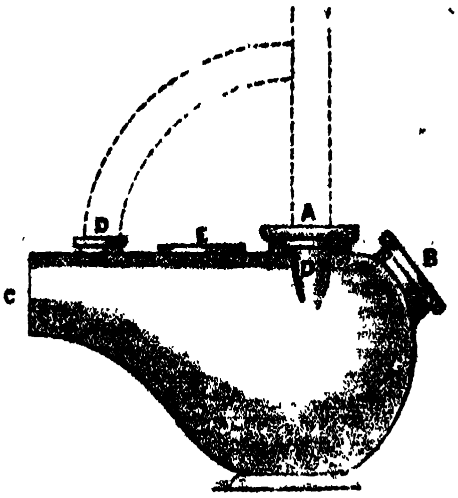
DEATH OF SIR WILLIAM FAIRBAIRN.

This eminent Manchester engineer died at ten minutes to one on the 18th ult., in the 86th year of his age, at Moor Park, Farnham, Surrey, where he had been staying during the past month, in the hope of benefiting his declining health. He was born at Kelso, in Roxburghshire, N.B., in 1789, and was educated at Newcastle-upon-Tyne, afterwards carrying on business at Manchester. During a long and useful life Sir William was constantly engaged in developing the capabilities of iron with reference to constructions of all kinds, and for a series of papers relating to this subject he received the medal of the Royal Society. He helped to establish the British Association for the Advancement of Science, and amongst his published works may be mentioned "Iron, its History and Manufacture," "Iron Shipping," and "Useful Information for Engineers." Sir William Fairbairn was deservedly created a Baronet of the United Kingdom in 1869, and he was besides a fellow of the Royal Society, a corresponding member of the National Institute of France, of the Royal Academy of Turin, and a Chevalier of the Legion of Honour.

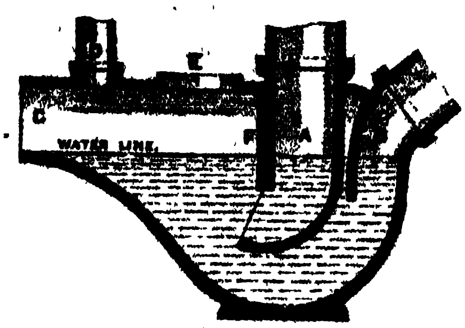
SEWAGE FARMING.

By invitation of the proprietor a party of about thirty gentlemen visited Mr. William Hope's farm of Breton, near Romford, recently, for the purpose of observing the results of experiments which he has carried on for the last five years in the application of sewage to land. He has for many years been an active promoter of the utilisation of sewage, and has fought more than one severe battle in that cause by initiating and supporting Bills in Parliament with the object of dealing with the sewage of the metropolis. The farm of Bretons he had leased of the Romford Local Board of Health, and on this ground he has put his favourite scheme into operation, not without success. The property is about 120 acres in extent, and its soil is naturally very poor, having been worth originally only about £2 an acre; but by means of the process applied to it by Mr. Hope it has so greatly improved that it now bears really fine crops of several different kinds. That process is simple in the extreme. The sewage of Romford—or part of it, for Mr. Hope complains that he has not had the full benefit of the produce of the town—is conveyed to Bretons, two miles distant, through pipes. There it flows into reservoirs, and is pumped up to above the level of the surrounding fields, and reaches them by gravitation through open troughs and gutters. The sewage thus distributed undergoes no chemical or other manipulation whatever; the solid particles are deposited on the coarser land, and the rest flows in a liquid state exactly as it left the place of its origin. Some very fine crops of wheat, all spring sown, were seen; several fields of splendid mangold-wurzels have been produced, [illegible] cow-cabbages, all of which had been grown [illegible] was, we were told, a remarkably good crop; and there was still on the ground the sixth cutting of rich Italian rye grass that had been grown during the year. [illegible] Mr. Hope has on his farm a stock of handsome and valuable cattle, whose [illegible] condition speaks well for the [illegible] fodder on which they are fed.

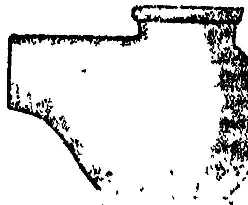
McNEIL GREIG'S VENTILATING SEWER TRAP.



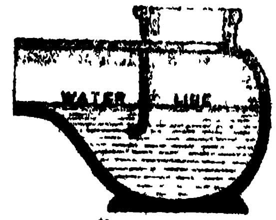
ELEVATION.



SECTION.



ELEVATION.



SECTION.

THIS appliance consists of a stoneware vessel, shaped like a bowl with a spout into this the soil-pipe is introduced by a socketed orifice, A, in the centre of the top, from which is continued a short pipe with its mouth below the water line, turned in the same direction as that of the vessel. Thus matter falling with impetus down the soil-pipe is shot forward with violence sufficient to create a current powerful enough to clear out any sediment from within the bowl. At the back is an inlet socket, B, to receive all the other discharge pipes from the same side of the house, such as sinks, areas, wastes, rain down-pipes, &c. the water from which would further tend to flush out the bowl and to keep it always charged with water, of which it holds about two gallons; C is the mouth or outlet delivery to the house-drain, D D are sockets for ventilating pipes, one of which serves to afford exit to all the gases generated in, or that find entrance into, the house-drain, and which naturally flow upward to this point, and the other for any that by any probability should pass the dipper of the trap F. The two pipes, D D, will be united above and carried to a deodoriser or any safe high point of the building, as shall be hereafter discussed. E is a lidded hole for access to the interior of the bowl to enable the trap to be examined and cleaned when necessary, and F is the bridge or dipper of the trap.

Now all that is required is to place one of these appliances a short distance from the wall of the house at sufficient depth (say three feet) to prevent injury by frost, and to allow of the pipes being led to it in an easy bend; then to fit the soil pipe into its socket at the top, and the several other pipes mentioned, by a junction branch at the back, and to dispose of the ventilating pipes in one or other fashion suggested, and the whole premises will be efficiently guarded from all chance of invasion by sewer gas, and all the waste pipes will be properly severed, as has been recommended in the former articles. It will at once be noticed from the illustration how much larger a body of water is retained in the trap than is usually the case, and thus forming a powerful resistant.

Its form and material are such as to prevent corrosion, which, we think, is much to be feared when cast-iron is the material employed. There are no angles in it, but the curves are all such as to be throughly swept out continually by the current. The internal pipe (which is connected with the soil pipe from above) conveys the discharge from closets well into the body of water beyond the bridge, towards the outlet to the drain, thereby preventing the return of fæcal offensive matter into the pipes or into the upper part of the trap beyond the bridge.

From careful experiments made it has been found that opaque refuse water and water containing a chemical of which the presence could be readily ascertained by tests, as well as floating bodies (wood, paper, &c) passed down from a water-closet, were each rapidly displaced.

It remains to be seen by longer experience how far this appliance will sustain rough and long wear and tear. There seems no danger of the soil pipe becoming clogged by the careless introduction of any bulky articles that could pass through its diameter at the upper part, as they would be safely delivered far beyond the bridge into the house-drain, and in this respect the invention possesses all the freedom stated to be required at the foot of soil pipes, just in fact as if there were no trap at all. The back inlet it would be as well to shield, for many reasons, from all chance of having bulky articles or grease carried down by the sink-pipe, and this might be done by placing below the sink a condensing and receiving chamber, whence by a grating only the fluid could pass to the trap. It would be found that thus a very large quantity of grease would be collected in such a reservoir that now is allowed to be wasted; and not only so, but to clog up drains and traps.

The inventor claims the following advantages in using this trap:—

1st. Its formation and material prevent corrosion.

2nd. It contains a much larger body of water than other traps hitherto offered to the public, thereby forming a powerful resistant against sewer gas entering house pipes.

3rd. The internal pipe (to which is connected the soil pipe from above) conveys the discharge from closets well into the body of water beyond the bridge to the outlet, thereby preventing the return of fæcal or offensive matter into the pipes, and into the upper part of the trap above the bridge.

4th. There is a second inlet, which is also trapped, to receive water from scullery sinks, areas and rain water pipes, which will cleanse the bottom of the trap.

5th. There are two ventilators in the crown, (one or both of which may be used) which relieve the trap from all offensive smells, by a distinct pipe conveyed therefrom to the top of each house.

6th. There is a man-hole provided to allow of inspection and cleansing, without disturbing the trap.

Correspondence.

PUBLIC ESTIMATION OF INVENTORS.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—I do not wonder that inventors get disheartened in this country. People say, I heard that was a new hobby of yours, and they annoy your family by addressing you as Patent A B C Maker. They use these A B C's themselves, and won't send a line to any one to say that they have done so. Our railway carriages are divided into six compartments, viz., first-class, second-class, and third-class, non-smoking, and smoking carriages for each class. In America you can go the whole length of the train, and show a drawing of an invention to several hundred people, but here you can, at most, show it to a dozen in a third-class perhaps. I find the Newcastle people the most intelligent I have met with, and would advise inventors to try that district. I went over to see the air-brake, but could not get sight of it.—I am, sir, your obedient servant,

C. BUTLER CLOUGH.

Chester, July 28th, 1874.

APPLICATIONS FOR LETTERS PATENT.

(*Continued from page* 129.)

rules, as well as the machine for producing the same. (Complete specification.)—W. R. Newton. Steam and other engines (com.)—L. Griffiths. Machinery for cleaning tin plates.—E. A. Voile. Machine or apparatus to be employed in the manufacture of Pontefract pipes.

On May 20th.—1784 to 1796.—W. S. Sutherland. Production and application of heat principally for welding or uniting metals, and means or apparatus employed therein.—J. Robertson. Furnaces for heating, reheating, tempering, or otherwise treating iron, steel, or other metals. —J. W. Huffman. Hand apparatus or travelling type to be used for printing.—S. B. Darwin. Method of lining or coating iron pipes.—W. R. Lake. Dog-collars (com.)—N. Edge and W. Trever. Looms for weaving.—H. J. Harber. Means or apparatus to be applied to stoppers, to facilitate the drawing off of liquids from bottles and other vessels (com.)—F. A. Harrison and C. Priestland. Apparatus for adjusting and fixing the cords of window blinds, maps, and other articles.—J. Marshall. Drum protectors and feeding apparatus for thrashing machines.—T. Vicars, sen., T. Vicars, jun., and J. Smith. Steam generators and furnaces.—J. M. B. Baker. Material for the manufacture of horse-shoes, applicable also for other purposes.—E. Iliff and J. Rinteul. Pianoforte action.—A. V. Newton. Rotary engines (com.)

On May 21st.—1797 to 1812.—T. H. P. Dennis. Adaptation of air inlets to stoves, furnaces, water boilers, or heating apparatus of any description, whereby perfect combustion and the economisation of fuel is secured.—S. S. Hepworth and G. Paulding. Centrifugal machines. (Complete specification.)—E. P. Alexander. Liquid meters, applicable also as a motive-power engine (com.)—J. A Ciogranti. Delivering lead (com.)—A. G. Henderson and D. Ritchie. Construction of liquid coolers or refrigerators.—E. Bell. Mode of working signals on railways, and apparatus for the same.—J. D. Brown. Power looms.—W. Whiteley. Machinery for sorting and spinning fibrous sub-

cleaners. (Complete specification.) — Isaac Bradley. Machinery for heading metallic cartridge cases.—F. H. Gales and J. Woodcock. Methods of and apparatus for lubricating the slides of steam engines and other machinery, and for filtering the lubricant employed.—P. E. Planet. Engraving.—J. H. Selwyn. Breech-loading fire-arms.—S. H. Smith. Apparatus for marking or scoring in the game of whist and other games of cards, and tables to be employed for such purposes.—W. R. Newton. Process for preparing hydrate of magnesia (com.)—A. G. Hunter. Treating bones, horn-piths, phosphates, and other materials in order to obtain products therefrom, and the apparatus or means employed therefor.—J. Joyce. Manufacture of waterproof paper or fabrics.

On May 22nd.—1813 to 1821.—J. H. Johnson. Eveners for wool cards (com.)—J. S. Crosland. "Economisers" for heating feed water for boilers by the waste heat passing from the furnace to the chimney.—H. J. Kennard. Sand pumps or apparatus for excavating sand and other material under water.—W. A. Wood. Mowing and reaping machines.—W. R. Trevelyan. Apparatus for securing or locking the barrels of breech-loading fire-arms.—G. Pearson, J. Dean, and T. Cowling. Screw gill boxes for preparing silk, wool, or other fibrous substances for combing.—J. S. Gabriel. Paving roads and ways.—E. O. W. Whitehouse. Producing electric light.—F. Ransome. Manufacture of artificial stone.

On May 23rd.—1822 to 1837.—F. Maigron. Looms for spinning hemp threads, waste silk, also for doubling and twisting wool, cotton, silk, and other filamentous substances. (Complete specification.)—G. F. Bradbury, T. Chadwick, and T. Sugden. Sewing machines.—J. Bell. Distilling coal shale and other substances for the production of oil and gas, and the apparatus employed therein.—D. Macfarlane and R. Macfarlane. Consuming smoke in furnaces or fire grates, and the means or apparatus employed therefor.—R. Goodall. Method of clarifying sewage and impure waters from dye works, bleach works, tanneries, mills, and manufactories, and rendering the precipitate or "sludge" combustible and useful as fuel.—J. Scattergood and B. Wilkes. Manufacture of bolts and spikes, and machinery to be employed in the said manufacture.—G. Knowles, jun. Carding engines.—P. F. Tarbutt. Method of preparing or rendering writing paper available as a means of advertising.—D. Hands and T. Scampton. Manufacture of Scotch caps or bonnets, and the apparatus employed therein, which improvements are also applicable in the manufacture of fabric for other purposes.—H. P. Holt. Metallic connections for attaching neckties and other similar habiliments.—J. Norman. Machines for washing and wringing.—W. Crosland. Bronzing or powdering printed papers or other materials, and the mechanism used therein.—S. Greenwood. Apparatus for the better regulating of steam engines, water mills, and wind mills.—J. B. Booth. Machinery or apparatus for preparing, spinning, doubling, and winding fibrous materials (com.)—A. Martin. Apparatus for saving life and property in case of fire, applicable also for lowering weights for other purposes.—C. S. Clark. Process for the preservation of meat, fish, and other articles of food and similar perishable substances.

On May 26th.—1838 to 1841.—A. G. Hunter. Manufacture of iron and steel and apparatus employed therein.—J. G. Tongue. Indelible ink (com.)—A. Jack. Making of fishing rods and reels for or connected therewith.—E. C. Prentice. Nitric acid.

On May 26th.—1842 to 1847.—R. Harlow. Boilers for hot-water apparatus.—C. S. Abel. Manufacture of steel shovels, spades, scoops, and such like implements (com.)—W. Murdoch. Apparatus for regulating and controlling the action of marine and other engines.—T. C. Dawson and J. Dawson. Printing machinery. (Complete specification.)—J. H. Johnson. Manufacture of yeast powder and prepared flour of a self-raising character (com.)—S. W. Wheeler. Art or process of reducing iron and other ores, the production of steel, and apparatus for the [illegible]

On May 27th.—1848 to 1857.—F. Gales. Feed [illegible] and ventilator, and portable refrigerator.—H. L. Smith. Guiding, driving, and [illegible] running on single rails.—E. [illegible] and G. Tresham. Manufacture of lace in twist lace machines.—A. M. Clark. Apparatus for carburetting air and regulating the supply to the burners (com.)—A. T. Adams. Compound winch for raising and lowering carriage (and other) windows.—F. S. Page. Self-locking car couplings (com.) (Complete specification.)—S. Ward. Cleaners for silk, cotton, and other like materials.—G. Zanni. Submarine and other telegraphic cables.—A. V. Newton. Rudders for screw-propelled vessels (com.)—J. L. Casartelli. Miners' dials or circumferentors.

On May 28th.—1858 to 1872.—J. H. Johnson. Manufacture of iron and steel, and apparatus employed therefor (com.) (Complete specification).—T. Stanier. Dressing machines, or apparatus for sifting meal, pollard, and other substances.—J. Leach. Door fasteners for railway wagons.—R. Edwards. Apparatus for separating substances of different specific gravities.—G. O. Gooday. Construction of horse hoes, the same being applicable to drills and cultivators.—S. Ballard and M. Pitts. Warming and ventilating factories, schools, churches, and other public buildings, also private houses or apartments.—A. Heald. Power looms and apparatus connected therewith.—T. H. Marsh. Clamping tools and screw wrenches (com.)—H. Jewitt. New and improved toy (com.)—E. T. Hughes. Manufacture of straw braided fabrics, and machinery therefor (com.)—W. Oram. Machinery for pumping or forcing water, air, or other fluids under pressure.—J. H. Johnson. Umbrellas and parasols (com.)—J. Duncan. Treatment and purification of sugar and saccharine matters, and the apparatus employed therein.—J. Willis. Umbrellas and sunshades.—B. Tower. Apparatus for indicating the velocity or rotation of any revolving spindle.

On May 29th.—1873 to 1886.—R. Nehrlich. Machine for producing cold and motive power. (Complete specification.)—S. de Nomaison. Treating mineral coals by acids.—M. Neuhaus. Constructions or forms of screw bolts and nuts, and appurtenances or appliances connected therewith, and with ordinary bolts and nuts to prevent them working loose from vibration or other causes (partly com.)—E. Hungerford. Medical compounds or liniments.—T. Wheelhouse. Leather-splitting machine.—O. J. Scholz. Machinery for putting capsules on to bottles and other vessels.—J. Hall and W. Hall. Sewing machinery.—W. Everitt. Apparatus for indicating the revolutions of the propeller shafts of steam ships and other shafts or revolving surfaces.—H. J. Barr. Apparatus for indicating the number of revolutions of the paddle wheels or screw propellers of steam vessels, applicable also to denoting the speed of steam engines.—W. Rainforth, sen., and W. Rainforth, jun. Rotary screens for dressing and separating grain.—G. Davies. Construction of hydraulic presses (com.)—J. Higgins and T. S. Whitworth. Machinery or apparatus for preparing cotton and other fibrous materials for spinning.—A. M. Clark. Ebullioscopes (com.)—C. J. Rowsell. Graphoscopes.

On May 30th.—1887 to 1902.—W. Cunningham. Equalising apparatus for carding machines.—W. P. Hartley. Manufacture of hard confectionery.—J. Hogg. Apparatus for teaching the alphabet and spelling.—G. L. Willis, jun. Hydraulic governor for steam engines, the same being also applicable to other kinds of machinery.—A. Brown. Brakes for railway carriages and wagons, and for carriages, waggons, and other vehicles employed on tramways and common roads.—E. O. W. Whitehouse. Revolution indicators and recorders.—R. E. Cooper and F. Cempis. Apparatus for locking railway signals and switches, and for locking railway signals and gates at level crossings.—J. Ford. Mechanism and arrangements for working tell-tale and other signals and switches.—J. Campbell and F. Gemmill. Construction of furnaces and their flues for the prevention or consumption of smoke.—J. Kirkman. Packing for the stuffing boxes of steam-engines and pumps, and for other joints requiring to be made steam, air, or watertight.—J. Irving. Packing for fragile articles (com.)—W. E. Lake. Machines for purifying and grading middlings (com.)—A. Miller. Apparatus for composing type.—A. M. Clark. Machinery for breaking, scutching, and hackling flax, and other fibrous materials (com.)—R. G. H. Shum. Composition for paving streets and other places.

On June 1st.—1903 to 1913.—A. C. Henderson. Mode of and apparatus for cutting fancy designs on piled or long haired fabrics (com.)—E. H. Jerson. Apparatus for indicating the revolutions of steam engine or other shafts or revolving surfaces.—G. C. Hassler. Fastenings for earrings.—J. Clark. Railway brakes, and means for operating the same or other brakes.—G. Richie. Apparatus combining bedstead, bedding, table, seats, shelves, and box, adapted for use in cabins, summer-houses, tents, marquees, and dwelling rooms.—A. Watson. Desks, despatch cases, and other similar articles.—W. A. Brown and J. Palmer. Mode and apparatus for indicating the number of strokes or revolutions made by an engine or other machinery in a given space of time.—L. P. Muirhead. Apparatus for indicating the speed of engines and other machinery and ships, suitable also for other purposes.—A. V. Newton. Mode of obtaining motive power (com.)—W. H. Williams. Manufacture of tubular or annular castings.—T. F. Salter. Improved machine for hoeing and cutting out root crops.—A. M. Clark. Stoppering bottles (com.)

On June 2nd.—1914 to 1926.—T. West and R. P. Brookes. Wheels and axles.—B. Tanner, F.C.S. Treatment of phosphates of lime, and the production of valuable products thereby.—J. H. Johnson. Apparatus for filtering or separating liquids from solid matters contained therein (com.)—A. Sauvée. Steam boilers and the apparatus connected therewith (com.)—W. H. Oliver, jun. Couplings for machine belting.—J. Moore. Looms and their application for the weaving wire.—C. Catlow. Looms for weaving.—A. Martin. Propelling vessels and apparatus to be used for that purpose.—S. W. Snowden. Safety valves.—J. Lamont. Mode and means of stoppering bottles and other vessels and construction of stoppers therefor.—C. W. Torr. Manufacture of metallic tubes, and machinery or apparatus to be used in the said manufacture.—J. Atkins. Manufacture of castors for furniture and other purposes.—J. G. Tongue. Machinery and processes for the manufacture of steam traps, partly applicable to other purposes (com.)

On June 3rd.—1927 to 1934.—J. Haley. Machinery or apparatus for pressing glass.—W. Corder and E. Shore. Manufacture of runners and top notches for umbrellas and parasols.—L. I. L. Schanzer. Instrument or apparatus for drilling and tapping or screwing mains under pressure, and attaching pipes, cocks, or connections thereto.—S. Tuddenham. Carriages for common roads, parts of which are also applicable to railway carriages.—R. J. H. Mills. Paper and pasteboard boxes, and machines for making the same, and for cutting and scoring paper and pasteboard therefor (com.)—W. R. Lake. Electric telegraphs (com.)—B. C. van der Hey. Apparatus for preventing the collision of railway trains (com.)—A. M. Clark. Apparatus for regulating and governing the speed of engines or machinery (com.)

On June 4th.—1935 to 1952.—T. A. Dillon. Method of indexing, copying, multiplying and securing public and other records and documents.—G. Hasseltine. Railway carriages, trucks, and axle-boxes (com.) (Complete specification.)—H. R. Marsden. Machinery or apparatus for crushing ores and breaking stones, and for crushing and breaking other hard and brittle substances.—C. Burton and S. Withers. Sash frames, and also the construction of and frames for raising and lowering sashes.—T. Martlock. Apparatus for removing the peel or skin from potatoes and other like vegetable substances.—Hon. W. E. C. Stanhope. Construction of skate especially adapted for use on artificial ice or smooth surfaces.—J. T. Plenty. Apparatus for "burring" and washing sheep skins.—R. Readhead. Steam boilers.—H. Davey. Apparatus for working the valves of steam or water pressure engines.—W. H. Howes. Manufacture of gas for lighting and heating purposes, part of which are also applicable to gas meters.—H. J. Gill. Machines for finishing printed sheets of paper.—R. M. Marchant, C.E. Machinery for the manufacture of ice and for other refrigerating purposes.—E. Dupont. Manufacture of cornets and other metal musical wind instruments.—M. Pullen and W. Pullen. Machine for adding together and ascertaining the total of a column or number of figures.—J. Kennett. Bed.—W. H. Clapp. Apparatus for ordering telegraphic messages and for transmitting signals, parts of which also relate to signal and other lamps.—W. R. Newton, C.E. Apparatus for extracting

greasy and fatty matters from various waste substances (com.)—G. G. Tandy and J. A. Dryden. Lamps.

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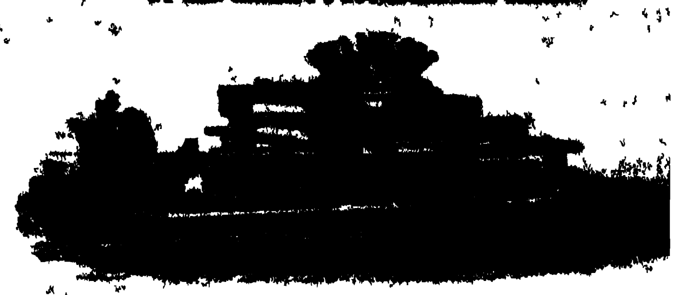

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DECEMBER 1, 1871.

CROWN RIGHTS AND INVENTORS' CLAIMS.

The case of *Feather* v. *the Queen*, which was decided some few years ago, caused a great stir amongst all those inventors whose ingenuity develops itself in improvements serviceable to the Government of the country. Not that there ought to have been any surprise if the question raised in that case had been properly examined into, for on no principle could it be supposed that the Crown could be legally bound not to use an invention (perhaps one that might be the salvation of the State), without paying the inventor just what he might please to ask, and especially if it be borne in mind that many years ago the case of Perring's Anchor Patent was before the Courts in regard to the question as to whether, when a patentee had supplied articles to the Government in pursuance of the proviso in the patent that he should supply same "at such times and on such reasonable prices" as, by the proper officers of the Government, should be settled," and it was decided (vide Adolphus and Ellis' Reports, p. 949), that no *mandamus* could be issued to compel the Government to carry out this proviso. It is true, Perring's case did not settle the whole matter, consequently there was room for raising the question whether in any way the Crown was bound to respect its own patent grant as applicable to itself, or was compellable to pay an inventor for the use of his invention by itself. *Clare* v. *the Queen*, and the above-mentioned case of *Feather* v. *the Queen*, seemed to dispose of this question altogether in favour of the Crown. However, recently, Mr. Lyall Thomas has brought forward the case in a new form by means of a Petition of Right on an alleged contract by the War Office with him to pay him remuneration for the use of his drawings and designs for heavy rifled ordnance. The late Attorney-General, Sir Henry James, demurred to the claim on the ground that a petition of right does not lie on a contract, nor on any other claim than for the restoration of lands or return of specific goods retained by the officers of the Crown, and as appears by the report of Queen's Bench proceedings in the *Times*, Nov. 21st inst., the case was argued last Term by Mr. W. Williams, on behalf of the petitioner; and Sir R. Baggallay, the Attorney-General, on behalf of the Crown; and as the Petition of Right Act expressly declared that it should not extend the law, the issue of the argument turned chiefly on ancient law, although it was stated by Mr. Justice Archibald (who drew the Act) that certainly an impression had ever since prevailed that petition of right was available in respect of debts or contracts by the Crown, and that many such petitions had been brought, and we have ourselves reported several such cases. At the close of the argument, the Court took time to consider their judgment, and Mr. Justice Blackburn on the 20th November delivered a written judgment in favour of the petitioner, and affirming his right to recover, and, as might be expected from that eminent judge, it is a lucid exposition of the law, which we have much pleasure in presenting to our readers.

The great question, he said, is whether petition of right will lie for any other object than the recovery of specific land or goods, as for breach of contract or for a claim of money either by way of debt or damages. We leave for future discussion who are the proper authorities to contract on the part of the Crown, and what particular contracts are within the scope of such authority—questions not raised in the present case. No doubt contracts may be made on the part of the Crown, and the Attorney-General, on the part of the Crown, can enforce them against the subject; and if the subject has no means of enforcing such contracts against the Crown there certainly would be a want of reciprocity. But it is settled that no action can be brought against the Queen, and that the redress, if any, must be by a petition of right, which is now regulated by 23 and 24 Vict. c. 34. If the suppliant ultimately recovers, he obtains under section 9 of that Act a judgment of the Court that he is entitled to such relief as the Court shall think just, and that form of judgment would be applicable to the case in which it appeared that the plaintiff was entitled to be paid damages for the non-fulfilment of a contract. But the 7th section of that Act expressly provides that it shall not give to the subject any remedy against the Crown in any case in which he would not have been entitled to such remedy before the passing of the Act. Undoubtedly, ever since the Act, a general impression has existed that a petition of right was maintainable for a debt or breach of contract by the Crown. We are now called upon to determine the correctness of this impression, whether before that Act a petition of right lay in respect of the non-fulfilment of a contract made by the authorised agent of the Crown. No statute gives such right, which if it exists must have existed at common law; and unfortunately the authorities to which we must have recourse are many of them antiquated and obscure. The argument against the petition of right lying in such a case is, we think, entirely grounded on the absence of ancient precedents; and that is undoubtedly a strong argument, for all the cases brought before us are cases of petitions to recover lands, except in two instances, one of which was the "Banker's case" in the time of Lord Somers, in both of which freehold annuities were recovered. It is too much to say that all the entries existing must be of this nature, and a search in the Petty Bag Office, where the records of these proceedings are kept might possibly result in the discovery of some in which there was a judgment in respect of a debt due from or a covenant made on behalf of the Crown. But none such have been produced, and the inferences sought to be deduced from the absence of precedents are that in early times, when the remedy by petition of right was formed, it was confined to cases in which the freehold was concerned, that being the only interest then of sufficient importance to lead to the framing of a remedy, or that from respect to the Crown the remedy was confined to cases in which redress could be granted by an order to the King's officer to withdraw, and did not extend to cases in which, unless the King chose to pay, there could be no effectual relief unless the King's treasure or lands and chattels were taken in execution, and that it could not be supposed that a judgment would be given which could not be enforced. We must observe as to this last argument that the moral effect of such a judgment, though it could not be enforced, must at all times have been great, and without adopting the whole of the polite fiction of the law, which, as, stated by Blackstone, presumed that "to know of any injury and redress it are inseparable in the Royal breast" (2 Com., 255), we may say that at all times the refusal of the Crown to pay its just debts was much more likely to be based on a sincere or pretended denial of the justice of the claim than on a barefaced avowal of an intention to refuse to do right. But we think that in at least one important branch of the law there is sufficient authority to show that a petition of right lay where the judgment could not have amounted to more than a declaration of the title to redress, leaving it to the Crown to give that redress afterwards. This was the case where the King had granted land with a warranty of title, and the title was impeached. In this case the judgment must have been either a dry judgment that the petitioner had a right to recompense in value, or one giving an execution against the lands of the Crown. After noticing *dicta* in the "Year Books" on the subject, the learned Judge proceeded to notice the entries in the *Rotuli Parliamenti* as to petitions which he showed were sometimes petitions of right and sometimes of grace. No one, he said, who looks at the Rolls, as published by the Record Commissioners, can fail to see that many of the petitions were not in the nature of suits after all, while many looked very like suits. We should be sorry if obliged to form an opinion on so obscure a matter as a ground for our decision, especially when such great authorities have differed upon it; and we think that it is not necessary to do so, for the reasons given by Lord Holt in favour of the judgment which was ultimately adopted by the House of Lords as well as for the reasons given by Lord Somers for reversing it. Both lead to the conclusion that a petition of right lies in such a case as the present. The learned Judge then entered into an elaborate examination of the case to show that this was so, and that on all hands it was admitted that a petition of right lay in such a case, though the House of Lords adopted Lord Holt's view that another and more summary remedy, by order of the Barons of the Exchequer upon the officers of the Crown for payment, was also available. The whole tenour of Holt's reasoning is that in any case where there is a legal right against the Crown there must be a legal remedy, and one which could be made effectual; and he expressly says that a petition of right was a remedy, though not, he said, the only remedy. Certainly there is nothing to indicate that in his opinion there was not in the case of a Crown debt even that imperfect remedy. Lord Somers, on the other hand, set himself to prove that petition of right was the only remedy, and says:—

"Indeed, I take it to be generally true that in all cases where the subject is in the nature of a plaintiff to recover anything from the King, his only remedy at Common Law is to sue by petition to the King;" and he expressly mentions debts due from the Crown to subjects. Nor can there be any doubt that he expresses a distinct and considered judgment that a petition of right would lie against the Crown for a simple contract debt, such as for wages; and unless we overrule this opinion, we must give judgment for the petitioner. But we do not find that this opinion of Lord Somers has been ever since questioned; on the contrary, it has been confirmed, as in "Comyn's Digest," title "Prerogative," where it is stated that petition of right lies if the King does not pay debt, as for wages, &c.; and Lord Chief Baron Comyn expresses no doubt as to the soundness of the doctrine thus stated. So in the latter part of the last century, Mr Justice Buller and Lord Thurlow both stated that a petition of right lay against the Crown on a contract ("1, Term Reports," 178); and a similar opinion seems to have been expressed by the Barons of the Exchequer in a more recent case (6, Simon, 220). In the Baron de Bode's case, in which the point was raised, though not decided, Lord Denman avowed "an unconquerable repugnance to the suggestion that the door ought to be closed against all redress or remedy" (6, "Queen's Bench Reports," 274)—a doctrine much resembling what Lord Somers called Lord Holt's "popular opinion"—that if there be a right there must be a remedy. In Lord Canterbury's case it was decided that the Sovereign could not be sued by petition of right for negligence (1, "Phillip's Chancery Cases," 301), and in a later Case in the Common Pleas it was held that the Sovereign could not be sued by petition of right for a wrong ("Tobin v. the Queen," 16 "Common Bench Reports," N. S. 310). But in neither case was any opinion expressed that a petition of right would lie for a contract, and in the latter case Chief Justice Erle expressly says that claims founded on contracts by the Crown are a class of cases legally distinct from wrongs. In the more recent case of Mr. Feathers, it was assumed on the judgment that petition of right lies where the claim arises out of a contract, as for goods supplied to the Crown on the public service ("Feathers v. the Queen," 6 "Best and Smith's Reports," 294) We think, therefore, that we are bound by the authorities to hold that the judgment on this demurrer should be for the suppliant. Therefore, by the above judgment, an inventor's claim is maintainable in point of law; though the case, not having yet been tried at *Nisi Prius*, and formally adjudicated upon, is not a full and formal settlement of the question, for which we shall watch with interest.

SUBSTITUTE FOR CANTHARIDES.

AN order just received by a chemical manufacturing firm of Indianapolis, Indiana, for one thousand pounds of potato bugs, may be classed as one of the curiosities of commerce. It has been discovered that these insects possess qualities which make them a good substitute for the Spanish fly, and there is a prospect that from being regarded as an unmitigated pest they may become a source of actual profit.—*The Druggist* (American).

THE BRONZE PENNY AS A POSTAL WEIGHT.—As the bronze penny weighs very little more than a third of an ounce, it may serve to weigh letters intended for France at the current single rate. Care must be taken that the beam of the balance does not incline on the letter side; and stamping the weighing is desirable.

Reviews.

PROMOTION OF SCIENTIFIC INDUSTRY.

"Journal of the Society for the Promotion of Scientific Industry." No. II. Manchester: Published by the Society at 9, Mount-street, Albert-square.

THIS is the second number of a periodical record of the work of the society named, the success of which is truly remarkable, for it appears by its first annual report, contained in this journal, that the first suggestion for the formation of a Society for the Promotion of Scientific Industry came from Mr. Frank Spence, in a letter to the *Manchester Guardian* of October 16th, 1872. The correspondence, both public and private, which ensued, and which has been printed and largely distributed, led to a meeting of gentlemen in the rooms of the Chamber of Commerce in that city. At this meeting were present Mr. Hugh Mason, President of the Chamber of Commerce, Mr. J. K. Cross, Mr. Frank Spence, Mr. W. Agnew, Mr. Henry Rawson, Mr. Joseph Thompson, and Mr. Samuel Radcliffe Platt. After considering a plan of such a society, submitted by Mr. W. G. Larkins, then the editor of the "Journal of the Society of Arts," London, it was resolved that the plan, with modifications, be adopted, and donations towards the foundation expenses were then made, amounting to £450.

Mr. Hugh Mason having been elected Chairman of Council, and having from the first thrown himself enthusiastically into the scheme, many other gentlemen soon gave in their adhesion, and it was found that the promoters were justified in the course they had taken. At the end of the first year the society has so able and distinguished a President as the Earl of Derby, and among its supporters many men of rank, science, and influence, whilst the balance sheet shows that it has had an income of £4,000 to deal with; and with regard to work, it has sent English artizans on a visit to the Vienna Exhibition of 1873, the result of the action of this society being that, by the cooperation of the Chambers of Commerce of Birmingham and Sheffield thirty-five were sent, and the result of their observations has been published in a volume of reports, which the Council venture to think contains much valuable information on the industries represented.

It has also held an exhibition of appliances for the economical consumption of fuel in the beginning of this year, in a building specially erected in Peel Park, Salford, the site for which was generously placed at the disposal of the society by the Corporation of Salford, reports of which, by Mr. W. Gadd, C.E., of Manchester, were given in the SCIENTIFIC REVIEW. The various exhibits were, it is said, of a much higher class than it was expected could be got together in the short space of time and with the limited means at the disposal of the society; and the attendance of the public was such as to show the council that they were justified in the course they had taken. The exhibition was to have been opened in person by Mr. Isaac Lowthian Bell, President of the Iron and Steel Institute. That gentleman, however, was unavoidably prevented from attending, but an admirable address on the economy of fuel was prepared by him, and read at the inaugural meeting. This address has been printed and circulated along with the other papers of the society. The total number of visitors to the exhibition was 53,480; and the presence of deputations from scientific bodies in France and Germany, and from the Government of the Kingdom of Saxony, showed that the interest extended over a wide area. The Council feel that much of the success of the exhibition is attributable to the valuable counsel and co-operation of one of its members—Mr. William Mather, who personally gave much time and the benefit of his practical experience to the arrangement of the exhibition.

The society has had placed at its disposal a gold medal for the encouragement of the economical production of peat fuel. The conditions under which it shall be competed for have not yet been arranged. Indeed, the specimens and processes exhibited at the recent exhibition go to prove that the problem how to make the best use of the enormous quantities of peat that cover so large a portion of our land is by no means an easy one to solve, and that any attempt to do so requires the most careful consideration The matter has been placed in the charge of a committee to arrange the competition.

We are much pleased to find that this one year old society can give such a cheering account of its success, and we cannot help thinking that it may be considered a very near relation to the Inventor's Institute, seeing Mr. F. Berger Spence and Mr. Peter Spence, both members of the Council of the Institute, are amongst the most active of the council members of this new society.

Beyond proceedings of the society, the Journal contains important papers on "Anthracen and its Derivatives," by Dr. Gustav Auerbach; on "The Decoration of Ceramic Ware—Pâte-sur-Pâte," by Edward Locke; on "The New Salt-cake Process," by George E. Davis; on "Trade Routes and Fairs on the Northern Frontiers of India;" on "Economy of Fuel in Mills," by A. Hildebrandt, C.E.; on "The Utilisation of Peat;" and Correspondence.

PROTESTANTISM.

"The History of Protestantism." By the Rev. J. A. WYLIE, LL.D., Author of "The Papacy" "Daybreak in Spain," &c. Illustrated. Cassell, Petter, and Galpin, Ludgate hill, London.

THE "History of Protestantism" will be enriched with original illustrations of a high character, and no expense will be spared to render the work in all its departments worthy of the great subject of which it will treat. Uniform in size and style with "Cassell's Illustrated History of England," it will combine all the valuable features which have secured to that history a circulation far exceeding that of any other history of our country With the first number of this work has been presented a magnificent presentation plate a copy of the great painting by Mr. E. M. Ward, R.A., "Luther's First Study of the Bible." The engraving of this picture, printed on plate paper, measures 26 in. × 20 in. The work appears to be high-class in every respect, but, as it touches polemical controversy, this is all we can say of it.

CONTAGIOUS DISEASES ACTS.

"Mr. Gladstone and the Contagious Diseases Acts." By JOSEPH EDMONDSON. F. C. Banks, 27, Great George-street, S.W.

THAT the race of Pharisees and pseudo-moralists has not died out, is evidenced by the support received for views antagonistic not only to the form and concomitant details of the Contagious Diseases Acts (which, we are free to admit, are not to our liking), but to the very basis of them, namely, governmental regulations to prevent the spread of those dreadful, loathsome social and physical pestilences, the effects of which fall too frequently on innocent and virtuous victims. In this pamphlet we have the old nonsensical ideas put forward that the physical deterioration produced by the unlawful indulgence of the animal passions must not be dealt with, because we may possibly thereby render vice safe and easy—a plan strictly analogous to what might be urged against many valuable social arrangements, as, for instance, fire insurance, which it can be proved often gives encouragement (though, of course, not intentionally) to the crime of arson, and our Marriage Laws to

the murder of wives and husbands, to say nothing of wife-beating. Why, the very things that most of these very virtuous ladies and gentlemen are prepared to uphold, namely, facility of restoration to respectable life of fallen females, in some cases involving the restoration of an adulterous wife to her husband's bed, are likely to encourage vice and profligacy; inasmuch as after enjoying the pleasures of sin for a season, all can be put right again. As to the argument that the surgical examination of women who have been in the habit of submitting themselves to mercenary prostitution is an unjustifiable violation of their feminine delicacy and sensitiveness, it is all moonshine, for any sensitiveness they can have in such a matter is not worth a moment's thought, considering, too, that in this country women of the highest respectability have not the slightest objection to being handled by male doctors in cases of childbirth and sexual complaints. There is nothing more important for the welfare of society than the *sana corpore*, except its combination with the *mens sana*, notwithstanding all that may be said by statesmen or orators who are making political capital or seeking popular applause. If these Acts are arbitrary (though they are not more so than School Board and Vaccination legislation), if they are one sided, if in the action of their working details they engender the evils they seek to cure, and we believe there is all this to be said against them, they should be at once amended, and virtuous people will do good service in effecting a proper amendment of them; but in working for their total abolition they are only seeking to uphold transcendental idealities to the detriment of practical social advantage.

EDUCATIONAL ENDOWMENTS.

"The Labour Representation League on the Uses of Educational Endowments." Published by Henry Broadhurst, Secretary of the Labour Representation League, at 5, Catherine street, Strand, London, 1874.

HAVING in our first article in last month's issue discussed in general terms the scheme propounded on the subject of Educational Endowments and Technical Education by the Labour Representation League, we shall at present merely remark that this sixpenny pamphlet contains a full exposition of that scheme; further, that everyone interested in the subject treated of ought to read it. We may mention, however, that Mr T Mottershead, who is so well versed in questions of this sort as to have publicly received, not so very long ago, the commendations of Mr Gladstone, then Premier, and Mr Henry Broadhurst, were workers in the production of this pamphlet, so that it may be regarded as the manifesto of working men who are quite capable of dealing with the subject in a proper manner; and, in fact, it presents an unanswerable case for the application of a large portion of our educational endowments to a sound system of technical education which is sketched out in this pamphlet.

SPIRITUAL TELEGRAPHY.

"The Two Discoveries; or Key to Pine's Spiritual Telegraph." This Key not only Unlocks the Abstruse Labyrinths of Mathematical Science, but enables every Person who values the privilege to converse as freely with Friends in Spirit-life as when they were on Earth. Containing a Series of Communications of the most Intense interest by this new invention, with an engraving of the instrument. By CLEMENT PINE. London: E. W. Allen, 11 Ave Maria-lane, and Stationers' Hall-court, E.C. Also published by the Author at Bridgwater, and to be had of all booksellers. 1874.

THE adherents of Spiritualism will probably find that the invention described in this pamphlet is one tending to advance the cause they have at heart. Not being one of the initiated, all we can undertake to do is, to state that Pine's Spiritual Telegraph is, as far as we can make out, a dial marked with concentric bands, the inner and smaller one having 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, thereon, and the outer and larger presenting the letters of the alphabet, with "&" added. The following directions are given as to its use:—"It is necessary for those not possessing strong mediumistic power to place one or both of the fore and middle fingers lightly on the hand of the instrument near its centre, taking due care to avoid using any power upon it, and to be as passive as possible and alone. It may be some days before any result is obtained." But when a spirit has the power to operate, there is generally first a slow movement of the hand of the instrument, followed by a rapid motion so as to go round several times without stopping. In such case ask the communicating spirit to move the hand more slowly, and stop at the required letters. This being done, it has been my experience continued daily for five months to have the name of the spirit first spelled out, followed by the communication." The work has an appendix which relates to what is termed a discovery in mathematics, being really dissertations on the properties of triangles, which will be found interesting to all who desire to advance the popularity of geometry.

WOOD'S INSECTS ABROAD.

"Insects Abroad," being a popular account of Foreign Insects: their Structure, Habits, and Transformations. By the Rev. J. G. WOOD, M.A., F.L.S., &c. Author of "Insects at Home," "Homes Without Hands," "Bible Animals," &c. Illustrated with six hundred pictures, by E. A. Smith and J. B. Zwecker. Engraved by G. Pearson. London: Longmans, Green and Co. 1874.

THIS, like all the productions of Mr Wood, is full of interest and instruction. His object in the present book, he states, to be two-fold: in the first place, to show us that the lowly, often despised, and abhorred creatures that move about the earth, always as the insects, often are not mere pests or nuisances as, in many cases they do work in the economy of nature, which is of great value to mankind, and the wonderful character of their structure renders them interesting objects of study. Incidentally many remarkable points connected with insect life are described as, for instance, their being used as food. Thus the bees not only furnish honey, but in several countries are themselves eaten in the state of grub, doing, together with the bee bread laid upon their cells. Several wasp larvæ also are used for food. Even the voracious mosquitoes are in some parts of the world themselves eaten.

It would be a very difficult task to compress into a small space anything like a synopsis of this important work. Our readers must therefore remain contented with a few specimens. The first refers to what may be termed classical insects belonging to the lamellicorns, and termed the scarabæides, one of which is the most celebrated beetle of their race, perhaps the most celebrated insect in the world. This is the sacred scarabæus (Ateuchus sacer), which was held in such veneration by the ancient Egyptians, and which is represented in such profusion on their tombs, and even on their personal ornaments; the reason of its sacred character, or at least one of the reasons, we shall presently see. The mode of depositing its eggs is very remarkable; our British beetles merely dig through the patch of cowdung, carry some of it to the bottom of the hole, and thereon lay a single egg. In those places, however, where the sacred scarabæus lives, such a proceeding is impossible, on account of the difference of the soil. The earth of our pasture lands is comparatively soft, and can be easily excavated, but, as a rule, in the country inhabited by the sacred scarabæus, the earth is hard and stony, so that the insect is obliged to search for a spot sufficiently soft to allow her to excavate. It is necessary, therefore, that the beetle should be able to transport from place to place a sufficient amount of the material on which the young larva is to feed, and this she does in a very curious manner. Taught by instinct, she gathers together exactly so much of the material as will give to the future young an ample supply of food, places in the midst an egg, works it into a rudely globular form, and then proceeds on her travels in search of a spot in which she can burrow. The mode of progression also is very peculiar. Turning her back upon the ball, and grasping it with the hind legs, she works backwards, pushing the ball along much as a horse backs a cart. Her perseverance in this work is really wonderful. The task is a very hard one, for the insect cannot see where she is going, and is just as likely as not to push the ball over a steep and stony hillock, which she might have skirted without the least difficulty. When quite tired out, she rests for a while, and then sets off again on her travels, seldom failing in the end to bring her labours to a successful conclusion. Her work is the harder because the ball is never quite spherical. At first, it is made rather at random, and by degrees becomes more rounded as it is rolled, just as a great snowball becomes rounder as well as larger while it is rolled through the snow. Still, the ball is never a smooth sphere, but is of an irregular outline, so that the difficulty of rolling it is much increased. There are two points in connection with this ball which are worthy of notice, the first being the instinctive attachment which the beetle feels towards it, and the second the utter want of reason in such attachment. It is hardly possible to induce one of these insects to abandon the ball which contains her eggs until she has laid it safely beneath the earth. But she cannot recognise her own ball from that of any other beetle, and if two females be engaged in the task of depositing their eggs and the balls be exchanged, neither insect seems to be conscious of the deception, but labours as cheerfully for the ball that contains her neighbour's egg as she did for that which held her own. For the perfectly instinctive and wholly irrational attachment to the egg ball, we have a parallel in our own country. There are certain little black-brown, swift footed spiders which spin no webs, but keep to the ground on which they catch their prey by fair chase. The female wolf spiders, as these creatures are called, may be seen in the summer time carrying about with them a little silken bag, containing their eggs. Nothing can induce them to relinquish their treasure, and the spider would sooner lose her life than her egg sac. Yet if, as in the case with the scarabæus, the egg sacs of two wolf spiders be exchanged both creatures are perfectly satisfied; and even if a little particle of cotton wool be rubbed up and placed in the way of a bereaved female, she will take it up and carry it about just as if it were her own egg sac. It is both on account of the shape of the egg-ball made by the scarabæus, and of the intense love which the insect bears for it that the ancients employed it as an emblem of the Divine Creator's power. The earthen ball, with the egg in its centre, was taken as an emblem of fertility and the attachment of the beetle to the ball was recognised as an emblem of the Creator's love towards his creatures.

Another class of insects possesses a somewhat painful interest, namely, that most important family of neuroptera, the termitidæ, popularly though wrongly, called white ants, of which Mr. Wood gives the following account:—"There are many species of termes, but all are very much alike in their habits. I have, therefore, selected one species, termes dirus, or the common white

ant, to serve as an example of them all. These insects are spread over most of the warmer parts of the world, and are useful or the reverse, according to the amount of population. In uninhabited districts the white ants are valuable beyond price, as, together with the wood-boring beetle, they aid greatly in developing the forest-growths. Though they can feed upon many substances, they are essentially eaters of dead wood, and their powers in this respect are almost incredible. Hating light, they always begin their work by boring a hole into the object which they are about to attack, and then devour the whole of the interior. They never break through the exterior, but leave a shell scarcely thicker than ordinary paper, so that nothing on the exterior indicates the vacuum within.

When they get into a house, and attack the woodwork, this habit of theirs is more than unpleasant, as no one knows whether the wood be sound and solid, or hollow and rotten, from one day's end to another. It may look sound enough, but if struck or pressed, the thin shell gives way, and the havoc within is disclosed. In the British Museum is an example of the ravages of the termites, which is so remarkable that it is here given to the reader. The piece of timber in question formed the lintel of a door in the Government offices at Jamestown. It was, originally, a large square beam, but the termites made their way into it, and reduced it to the singular condition which is shewn. The manner in which the insects have set to work is very curious. After boring a hole into the beam, they began to eat the softer portions of the wood, avoiding for the present all the knots, so as to leave them projecting exactly as they grew in the tree. Having done this, they had begun to destroy the knots themselves by boring tunnels into them, so that there is scarcely a knot without one or two holes in it. When they had proceeded thus far, the mischief was discovered, and the damaged lintel removed and sent to England as an example of the havoc which termites can work. Even furniture is not safe, especially if it be left undisturbed for a few days. Suppose, for instance, that these insects have found their way into a house, and a table has been negligently left without having its feet placed in saucers of water, the termites will begin by boring a hole through the planking of the floor, and into the leg of the table. They will then hollow out that table so completely, that if a weight be placed upon it there is a crash and a smash, and nothing remains of the table but a heap of splinters and a cloud of dust. Several species of termites exist in the warmer parts of Europe, and at La Rochelle they have quite got the upper hand of the inhabitants. Not even a plank can be left for two days without being riddled by these insects, which attack the wooden fences, the stakes to which young trees are tied, and even the trees themselves. They have quite taken possession of the houses. In the Prefecture for example, they have done terrible mischief. They have burrowed into the woodwork to such an extent that on one occasion when a clerk stumbled as he was going down-stairs, and caught at one of the oak posts of the balustrades, his hand went completely into it, and was buried up to the wrist, the termites having eaten out all the interior, and left nothing but a mere shell scarcely thicker than the paper on which this account is printed. There is every reason for believing that the Prefecture was the original headquarters of the termites which were brought from St Domingo by some rich shipowners in the year 1780. Some men were engaged in building a house, which was afterwards converted into the Prefecture, and the termites gained admission by having got into some bales of goods brought from St. Domingo. But, great as is the inconvenience thus caused by these insects, it is nothing when compared with the irreparable damage which they have done to the very history of the place. They contrived to reach in their silent, darkling ways, the office in which were kept the archives of the department, and every single paper was destroyed without anyone knowing it. They did with the bundles of paper exactly what they do with timber. They first bored into the interior, and then set to work to eat all the paper. But they took care not to bore through the upper sheets, nor to eat through the edges, so no indication of the mischief was given until one day it was discovered that nothing was left of the archives except the upper sheets and the edges of the leaves.

"Polarization of Light." By WILLIAM SPOTTISWOODE, M.A. Macmillan and Co. This is a very important and interesting work, for polarization of light is one of the most captivating of scientific phenomena. The work, amongst many other interesting things, treats of the colours produced by plates of crystal when submitted to the action of polarised light, and describes how, in the phenomena of circular polarization, mechanical means have been used to produce in uncrystalline bodies, particularly in unannealed glass (or glass which has been rapidly and, therefore, unequally cooled), effects of this kind similar to those naturally produced in crystals. The polarization in the sky or atmosphere, produced by the scattering of light due to the presence of particles of different degrees of minuteness in the air, is then treated of; also the connexion of this with the sun's position in the heavens, and the contrivance of Sir Charles Wheatstone's polar clock to determine the time of day by it. Other bearings of the subject also receive attention.

REVIEWS POSTPONED.

"Brinckley's Astronomy" (Longman).

"An Elementary Exposition of the Doctrine of Energy," by D. D. Heath, M.A. (Longman).

"Transit of Venus," by R. A. Proctor, B.A. (Longman).

"The Aerial World," by Dr G. Hartwig (Longman).

"Elementary Dynamics," by W. G. Willson, M.A. (Thacker and Co., Calcutta).

"On the Origin of Civilization and Primitive Condition of Man," by Sir John Lubbock, Bart., F.R.S.

"The Draughtsman's Handbook," by G. G. André, C.E. (Spon).

LITERARY ANNOUNCEMENTS.

We read the following in the *Athenæum*: --A curious MS. has just reached this country from Rome. It is entitled, "The True and Wonderful History of the Lamentable Fall of Anthony Tyrrell, Priest, from the Catholic Faith, written by his own hand. Before which is prefixed a Preface showing the causes of publishing the same unto the World." Tyrrell, who was one of the witnesses against Mary, Queen of Scots, was a sort of Vicar of Bray. He changed his religion three times, but eventually died holding large preferments in the Church of England. The MS., which is now in the Public Record Office, will, it is to be hoped, be published.

The Conseil Municipal of Paris, on which there is a Radical majority, had decided to publish from the city archives a volume "La Prévôté d'Etienne Marcel." But Etienne Marcel's Commune of Paris was so singularly like M. Félix Pyat's Commune of Paris that the Préfet of the Seine has stopped the publication of the work—at all events, for the present.

Lord Houghton is progressing with a new edition of Keats.

The Christmas story of "Once a Week" is from the pen of Mr. G. M. Fenn, author of "Ship Ahoy!" and is entitled "Sixty per Cent.: a Domestic Ditty."

Prof. Vambéry has in preparation a work entitled, "Islam in the Nineteenth Century: an Essay upon the present State of Civilisation in Mohammedan Asia." The effect of modern ideas upon the social and political condition of the Asiatic Mohammedan countries is to be considered, as well as the future of those nations forcibly taken under tutelage by the West. French, English, and German editions are to appear simultaneously.

Lieut.-Col. W. E. Marshall, author of "A Phrenologist among the Todas," is engaged on a work to be entitled "The Scientific Aspect of Polyandry," giving the results of travel and residence amongst the races occupying the Western Himalaya Mountains.

"The Supernatural in the New Testament, Possible, Credible, and Historical; or, an Examination of the Validity of Recent Objections against Christianity as a Divine Revelation," by Prebendary C. A. Row, of St. Paul's, is in the press.

Some curious specimens, says the *Athenæum*, of the new system of photo-lithography as applied to Chinese have recently been brought to our notice. They consist of a series of "Wall Papers," intended for gratuitous circulation in China, each of which contains in the centre a large engraving of a Bible subject, taken from the *British Workman*, and on either side a description in Chinese, rendered in the words of the Bible. These Chinese characters were penned by a Chinese scholar, and by means of photography were transferred by Messrs. Partridge and Co. to stone. They have, therefore, all the appearance of written characters—a circumstance which will, we doubt not, attract the attention of the Chinese who have the taste to prefer the rounded and easy strokes made by a native brush to the hard and angular lines stamped by the metal type usually employed by foreigners in printing Chinese.

By the death of M. Taschereau, recorded a short time ago, the literary world of France has suffered no insignificant loss. As an author, he is best known by his lives of Molière and Corneille, and by his editing of Tallemant des Réaux, and the Grim-Diderot correspondance. He was also a frequent contributor to various journals, the *Revue de Paris* and the *Revue Française*. But his chief claim to distinction is his sixteen years of skilful management at the National Library. This post he obtained by entering into political life, and writing in such a way as to be looked upon with favour with the late Emperor.

Mr. Walter Thornbury is preparing for the press a second edition of his "Life of Turner." It will contain, we are told, many hitherto unpublished letters, and a large number of fresh facts about the painter. Mr. Thornbury will bring out at Christmas a volume, containing a selection from the poems he has from time to time written, under the title of "Twenty-five Years on the Slopes of Parnassus." It will be illustrated by Messrs. Millais, Tenniel, Sandys, F. Walker, Green, Pinwell, the late T. Morton, Whistler, Houghton, Poynter, H. S. Marks, and the late Mr. Lawless.

An effort is being made to found a Chair for Celtic in the University of Edinburgh. The Council of the University have appointed a Committee, with Prof. J. Stuart Blackie as Convener, to promote the object. The Professor has commenced agitating the question in the North, and has already obtained considerable sums towards the £10,000 required.

Miss Jean Ingelow will contribute a new story to *Good Words* for 1874. The title, we believe, is "Fated to be Free."

There is a talk of bringing out a magazine, to be called *The Church Quarterly*, as the organ of the "Anglican" party, which has had no representative among the Quarterlies since the demise of the *Christian Remembrancer*.

Mr. D. M. Aird, of the Middle Temple, author of "[illegible]," &c., has undertaken a work that is [illegible]

piled, "The Civil Law of France to the Present Time," which comprises all the rules of the Code Napoleon. He has appended explanatory notes, which show the analogy that exists between the Laws of France and the leading Principles of the Roman Law.

The New York *Publishers' Weekly* announces that the first volume of a translation of the Count de Paris' "History of the Rebellion," by Mr. L. Tasistro, of Washington, formerly translator for the State Department, may be looked for in November or December.

A new department has been inaugurated in the Guildhall Library and Museum by Mr. Overall, or rather two. The pictures of the Clockmakers' Company make the beginning of an historical loan gallery, and in another hall Mr. Overall has placed their fine collection of proof engravings of Earn-haw, Mudge, Arnold, and so many eminent horologists. If other companies follow the example, Guildhall will soon make its mark among the special museums.

The writer of the article on "English Fugitive Songs and Lyrics," in the current number of the *Edinburgh Review*, is Mr. George Barnett Smith.

Mr. R. K. Douglas, of the British Museum Library, has been entrusted with the task of editing the *Proceedings* of the Oriental Congress, which will include the papers read before the various Sections.

M. Guillaume Guizot, son of the illustrious statesman, has been lately in London, engaged in making researches with respect to Early English literature, especially that of the Chaucer period, on which he is about to deliver a course of lectures at the Collége de France.

A new and revised edition of "The Records of the Past" is in progress, and will shortly be issued.

"THE BOOK-SELLERS' CIRCULAR AND BOOKBUYERS' GUIDE" is the title of a new monthly Journal of current Literature, uniform in size and price with the *Literary Mart*. It is established for the purpose of presenting in a readable form publishers' announcements of new books, through which bookbuyers may obtain such information as is ordinarily afforded by a perusal of the prefaces, or an inspection of the books themselves. It will greatly assist the retail country bookseller (to whom it is supplied at a reasonable rate in special wrappers for circulation among their customers) and be valuable to the bookbuyers. A special Illustrated Christmas Number will be published early in December, to be called "*The Booksellers' Christmas Annual.*" We recommend our readers to apply for specimens to the publisher, Mr. W. H. Goulden, 271, High Holborn, and 131, Fleet-street, London.

EXTERNAL SCREW CUTTER FOR BOTTLE NECKS.

LAUCHLAN ROSE, lime-juice merchant, Leith, and James Brown, glass-cutter, 14, Arthur-street, Edinburgh, both in the county of Edinburgh, have recently patented "An improved tool or shears to produce an outside screw on the neck of bottles;" and said improved tool or shears they state in the specification of their patent consists in a cup-shaped circular mould, the inner sides or surfaces of which have produced thereon the screw to be produced on the necks of the bottles, and of the required size for the neck of each bottle.

This cup or mould is attached to a tube or casing [illegible] in [illegible] tube or casing is placed a [illegible] of the [illegible] required for the inside of [illegible] the bottle, such plunger being [illegible] with a spring which is attached to [illegible] so that the workman [illegible] plunger, and this [illegible] it into the [illegible] the [illegible] the screw, after which, on withdrawing the pressure upon the spring, the plunger recedes to its normal position inside of the tube or casing, when the bottle is to be unscrewed from the cup or mould.

THE NAGPUR WATER WORKS.

THE author, Mr. Alex. R. Binnie, M. Inst. C.E., in this paper, which was read at the Institution of Civil Engineers on November 10th, described the position of Nágpur, the geological formation of the district, and the former works of water supply. The population of the city was 84,000, and the annual rainfall was 40·73 inches, of which 37·52 inches fell in the monsoon months. The new works had been constructed on the basis of an old native tank at Ambajhari, four miles from the city. The present reservoir had a total capacity of 237,500,000 cubic feet, with a water surface of 370 acres. It was fed by a catchment area of 1,224 acres, and was calculated to afford a daily supply of 15 gallons per head, under all the circumstances of fluctuating rainfall and of years of extreme drought. The embankment of the reservoir was 1,033 yards in length, and was formed on the site of the former one, through which a puddle trench had been sunk, and afterwards the bank was raised 17 feet 4 inches. Floods were discharged over a weir 200 feet long. The water for the city was drawn off through a straining tower in the reservoir, by a syphon which passed over the old embankment and below the newly raised portion. It was conveyed to the city in a cast-iron main 13 inches in diameter, and was distributed through a length of 10,500 yards of smaller pipes. The water service was principally a public one. The cost of the works had been £40,000, being at the rate of 9s. 5d. per head, or £31,600 per million gallons of water supplied per day.

In 1872, the intensity of the rainfall at Nágpur varied from a rate of ½ inch up to 4·735 inches per hour, the heaviest fall recorded was 3·55 inches in forty-five minutes. In an extreme case, 98 per cent. of the rainfall flowed off the drainage area in two hours and fifty minutes. The average yield of the drainage area was 38 per cent. per annum of the rainfall. The capacities of reservoirs to afford certain quantities of water at Nagpur were stated in a table, from which it appeared that a supply for two years should always be the limiting capacity for safety. From one season's observation the author believed that the evaporation from the surface of the reservoir amounted to 4 feet, or about 1-5th inch per day, and that the quantity of water lost to the reservoir by evaporation during the dry months was 54 per cent.

From a study of the records of rainfall at Calcutta, Bombay, Madras, Nágpur, Mauritius, Barbadoes, Adelaide, Hobart Town, Cape Town, New York, Rome, Greenwich, New Bedford, U.S., and Prague, the author deduced that the fluctuations were similar in kind, and that they only differed slightly in amount. He compared them under the following heads, the results being given in a table: per centages of the number of years whose fall was above or below the average; the average fall of all the years above and below the average; the average fall of the three driest consecutive years; the maximum and minimum fall, and the extreme range or difference between them; the proportionate number of periods of three consecutive years below the average per hundred years; the greatest number of consecutive years below the average; and the average fall of the greatest number of consecutive years below the average. The author did not advocate any strict rule to be applied in all cases, but pointed out certain broadly-marked features, which he considered generally applicable to India, as well as to other parts of the world. He also investigated the probability of the fluctuations of the rainfall being affected by the solar spot periods. The results were recorded in a series of tables, the conclusion arrived at being that the suggested connection could not be proved, and that even if it existed, the amount was too small to be of professional importance.

RICHARDS' MONEY-TAKING, REGISTERING APPARATUS.

THE object of this invention is to provide an apparatus whereby each person employed to receive money, either cashiers or [illegible] way fare, admission to places of amusement, for refreshments or otherwise, confirms the same in the presence of the person paying, either by pressing a button, actuating a lever, turning a handle, or any other manner that gives the necessary motion to the machinery, which records the payment on a dial, and at the same time strikes a bell, or similar contrivance to indicate to the ear that such payment is recorded.

The machine, in its simplest form, consists of two metal plates in a perpendicular position, with pillars between them, similar to an ordinary brass clock frame.

Between these plates is a horizontal ratchet wheel, fixed to a perpendicular shaft, revolving freely in its bearings. A horizontal rod, somewhat longer than the distance between the plates, protrudes through the front plate, a length equal to the distance between the teeth of the ratchet wheel; this rod is guided within the frame, and at the end protruding is fixed thereon a knob or button.

The horizontal rod is provided with a pall or detent, which falls into one of the spaces of the ratchet wheel, so that when the button, at the end of the bar, is pressed or pushed forward, the ratchet wheel is made to move a distance equal to that from one tooth to another. A spiral or other spring causes the bar to return to its former position. To prevent the ratchet wheel returning there is a second pall or detent as ordinarily practised in mechanics, and to this pall is attached the hammer for striking the bell, a spiral or other spring retaining the pall in its position.

Attached to the ratchet wheel is a cylinder having on its periphery figures engraved corresponding with the teeth, which figures are seen through an opening in front plate of machine; thus, by pressing the button the payment is indicated on the cylinder and at same instant the bell is struck, so conveying to the ear as well as to the sight that the amount is recorded.

For the purpose of indicating large numbers on the top of the shaft of the ratchet wheel, is employed (although any gearing may be adopted), by preference, a worm working into a toothed wheel, and the axle of this wheel may carry a hand, so indicating on a dial the number of payments made, or there may be a series of dials similar to those of a gas meter.

The machine described is intended only to record like amounts, but when there are several amounts as 2d., 3d., 4d., &c., a distinct apparatus, being combined or separated, is requisite for each amount, the bells having different notes, so that an accustomed ear can detect by the sound the amount recorded.

Various modifications of the instrument can be made, either by placing the ratchet wheel in a vertical position, and giving the motion from above, as would be the best method for counters or other fixed places.

For setting the machine at zero, as at the commencement of the day or week as the case may be, the bottom of ratchet shaft is squared, and there being a corresponding hole or holes at the bottom of machine, with a suitable key, the pointers are placed as required. To prevent fraud at this point the holes are covered by a plate, secured either by lock and key, seal, or other [illegible]. The instruments can be made so as to be portable, the conductor of a tramcar having

it attached to a belt, so in the act of receiving money in the presence of the person paying indicates it on the machine.

I also purpose to attach, when desired, a clock with dial or other contrivance, so as to show the precise hour or time when the payments are made. The apparatus above described may be modified in various ways, so as to obtain the same results.

The inventor and patentee of this ingenious invention is Mr. William Richards, of Burton-road, Brixton.

PROMOTION OF INFECTIOUS DISEASES BY SCHOOL BOARD ACTION.

The following case, illustrating the harsh, unthinking, mode of action of the School Board zealots, cannot be too widely known, as it is only one sample of the doings of those who, by so called popular election, have been put into high places to popularise education, but who are in reality rendering it odious to the people:—In the *Times* of Nov. 9, 1874, Dr. W. Vacy Lyle, M.D., medical officer, Western Paddington, wrote to state that a poor woman named Turner, 21, Alfred-road, Harrow-road, was summoned at Marylebone Police Court for neglecting to send her children to school, and was, by the magistrate, fined three shillings or three days' imprisonment, and having no money was sent to prison for three days. It seems one child had been sent to Stockwell Hospital by Dr. Lyle for fever, and she gave this as reason for keeping her children away from school; she was a widow in much distress, and if the people of the house in which she lived had not looked after her children they would have starved during her imprisonment; when she came out of prison she was relentlessly summoned again before the magistrate; but being this time armed with the doctor's certificate, was lucky enough to find the magistrate in a mood to excuse her.

The matter having thus been brought prominently before the public by so influential a journal as the *Times*, it got some notice taken of it by the supreme authority. At the London School Board, in full meeting assembled, on the 19th November, according to the *Times* report, the chairman stated that Dr. Lyle had (in consequence presumably of communications from the School Board) written a letter stating that, had he known that the woman was such an offender, in regard to keeping her children from school, he should not have written to the *Times* as he did. A letter had also been received from the clergyman of the parish, approving of the action of the Board in respect of this prosecution — just as if, supposing the delinquencies of this poor woman to be as represented, anything could justify forcing her to send her children to school at a time when it might be reasonably expected they were either carriers of infection or sickening for infectious disease. It is really alarming to think how diseases may be propagated by compulsory school attendance, which our educational zealots, one may be sure, will never allow to have been due to that, but will rather seek for all sorts of nonsensical theories to account for the spread of such diseases. The whole case forcibly illustrates how vain man, dressed up in a little brief authority, plays strange fantastic tricks. The School Board people proceed to fill their schools, regardless of poverty or of disease, with stern disregard for hunger or illness, it being with them a favourite notion that it is of very little consequence what becomes of the body so long as the mind is well filled with book-lore. The magistrate rigidly enforces the law much in the same spirit. The doctor, after pleading for the victim, is half ashamed of what he has done; and even the minister of the God of mercy rejoices! the School Board making all smooth and pleasant for all with "Hear, hear, hear."

OPENING OF SESSION OF INVENTORS' INSTITUTE.

On Thursday, 26th November, a Special Conference of the Council of the Institute, members, and friends of Patent Law Amendment, was held at 4 o'clock p.m., at 4, St. Martin's-place, Trafalgar-square. Pending the arrival of the President of Council, Sir A. Brady, Mr. H. A. Fletcher, F.R.A.S., a council member of long standing, occupied the chair, which was afterwards filled by the President.

The Secretary, Mr. F. W. Campin, commenced proceedings by stating that it had been thought desirable, as there would be a number of members from the country coming up to town to the Opening Dinner of the Session, to be held that evening at St. James's Hall, to devote this meeting to discussing and settling the nature of the arrangements with regard to the deputation to the Lord Chancellor on the subject of the Patent Laws, a matter which had now become an immediate one, as his lordship had fixed the 16th December as the day for receiving the deputation.

Mr. Campin then remarked that the practical business of the meeting would be to settle the list of members to attend the deputation, and arrive at a concurrence of views as to what should be stated as the requirements of the Institute in regard to patent reform, as a guide to which he would state that in the spring of this year a printed slip was issued to all the members, requesting them to give their views on four principal leading points; and these had all been affirmed by a great number of members. They were:—

1. Cheaper patents.
2. Better procedure for obtaining patents, so that by preliminary investigation the soundness of patents should be practically guaranteed, with provisions for establishing them as indefeasible, and preventing fraudulent grants.
3. Improved Patent Office and Museum arrangements.
4. Better protection by a more certain and less costly system of law process for supporting patents against infringers.

All these points were embodied in the proposed Bill, which, as also an abstract, had been already printed and published in the Institute's journal, The Scientific and Literary Review.

Sir Antonio Brady remarked that having given great attention to this subject, and having had the opportunity of personally examining the working of the Patent Laws of America when in that country not long ago, he was decidedly of opinion that we could not do better than take the general principle of those laws as the basis of an amended Patent Law for our own country, for his own view was that if the Government granted a patent it ought to take care that it was granting a thing of some value that could not be upset in a court of law without difficulty, indeed with sufficient previous notice and investigation, he did not see why a patent should not be rendered absolutely indefeasible. This was, in a great measure, effected by the American system of preliminary examination, which he could bear testimony was conducted in a most admirable manner; and as regarded their Patent Museum, it stood out in splendid contrast to our own miserable corner at South Kensington, and he thought that an improved museum should be an important point in an amended patent system. He and other members of the Institute had formed part of a deputation to the late Lord Chancellor to bring under his notice the disgraceful state of the Patent Museum, and they had convinced his lordship of the necessity for immediate action in the matter; but, of course, the late change of Government had prevented any practical results accruing from this up to the present time. Sir Antonio then adverted to several cases of legal proceedings in regard to patents, showing that a patent was a mere title to go to law, and was in reality a standing disgrace to our national character. He was glad to find amongst them several representatives of the working classes whom he had had the pleasure of meeting at the Conference held by the Institute in August last, and this led him to remark that there was a question now coming before the public, specially affecting working people, which to his mind was intimately connected with the Patent Laws, namely, technical education, for if that be improved and the Patent Laws left without amendment, it will be said how absurd to train a man to become an ingenious mechanic and then to deny him any advantage from the exercise of his ingenuity.

Mr. Paterson said, as one of those so kindly alluded to by the President, he must observe that it appeared to him that the present Patent Law was a miserable rag of the old feudal system, and required reform root and branch. As far as workmen are concerned, what was wanted was cheap patents and efficient protection.

Mr. Savage concurred in these views.

Mr. Newton Wilson said he would like to know how this could be carried out in practice.

Mr. Blanchett moved, Mr. Hand seconded, and it was carried unanimously, that those present, with power to add to their number, do form a committee of deputation to the Lord Chancellor.

Mr. Broadhurst expressed his approval of all that had been said that evening, remarking that for himself he had only to say he was quite ready to join in the movement for amending the Patent Laws, which should go hand in hand with technical education, for he felt that the two combined would render inestimable benefits to the working classes, and be of the greatest good to the country.

Mr. Banting Rogers thought that the increase of the Protection of Patents was far more important than the rendering them cheaply obtainable.

Captain Selwyn, as an old member of the Institute, was pleased to find that some amendment of the Patent Law was likely to be brought about, and he hailed with pleasure the right hand of assistance held out by the working men, whom he did not doubt would do good service to the movement. Although he well knew that the Bill prepared by the Institute was a real practical measure, he thought it would be unwise to urge it as the right thing to be done, and he would move that a sub-committee be appointed to act in accordance with the following instructions:—

To arrange the deputation, whose duty will be to urge the amendment of the Patent Laws on the principle of the American system. To propose the views of the Inventors' Institute as worthy of consideration *pari passu*, with any others, for the future amelioration of the American system in the sense of indefeasibility of patents, and the extension of patents which have been unremunerative.

This being seconded by Mr. Varley, was carried unanimously. It was then agreed that the President of Council, the Secretary, and Captain Selwyn, Messrs. Paterson, Varley, Savage, and Broadhurst, be a sub-committee to make arrangements as to the deputation, and with a vote of thanks to the Chairman, the meeting ended.

The dinner took place at St. James's Hall the same evening; it was well attended, Sir Antonio Brady presiding. Major Beaumont, M.P., Captain Selwyn, R.N., Captain Grenfield, R.A., Mr. Campin, the secretary, and Messrs. F. Ransome and Henry Williams. Several eminent American and other foreign inventors were present and responded to toasts. We are, however, compelled to defer our report till our next.

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Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

President of Council:

SIR ANTONIO BRADY.

MEMBERS MEETINGS AT 8 P.M.

Thursday, December 3rd. Captain Bingham, "On a Double Blade Propeller," and "On Engine Room Skylights."

Thursday, December 17th, W. Gadd, Esq., C.E., "Combustion of Oils for Steam Generation."

Council and Executive Meetings on the same Evenings at 7 p.m.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.
F. W. CAMPIN, Sec.

Proceedings of the Institute.

At the meeting of Council (special and ordinary) held on 12th Nov., 1874, Mr. F. H. VARLEY, V.P.C., presiding, the Secretary was directed to at once take measures to forward the Patent Law Reform movement, in accordance with former resolutions of the Council.

It was resolved unanimously that the opening dinner of the session, 1874-1875, take place on 26th November.

It was also resolved that the meeting on the 26th be held at 4 p.m., and that its proceedings be restricted to arranging for a deputation to the Lord Chancellor on the subject of Patent Law Amendment. With this the proceedings of the Council terminated.

At the Executive Committee held immediately after the above Council, the question of papers to be read and subjects for discussion at the members' meetings in the present session was considered. The papers to be read by Capt. Bingham were accepted, also a paper by W. Gadd, Esq., C.E., Manchester, on and it being intimated that papers on Railway Carriages, and on the Conveyance of Gunpowder were likely to be brought forward, it was agreed that these would be eligible. It was resolved unanimously that the Executive hereby approves of the proceedings of the Dinner Committee, and requests them to proceed with their work so that the dinner may be held on 26th November. It was also resolved that it is desirable to print the Patent Law Bill of the Institute in a separate form. It was further resolved that it is advisable to have some members' meetings devoted to the demonstration of 'Groups of Inventions,' and two members were constituted a Sub-Committee to consider and report thereon.

It was resolved that the meeting on 26th be held at 4 p.m. (see resolution of Council).

The proceedings of the meeting of 26th November will be found in another column.

Monthly Notices.

The Transit of Venus Expeditions.—Intelligence has been received of the safe arrival of most of the English transit-of-Venus observers at their head-quarters of destination.

The quicker Oxidation of Iron Rails when not travelled on over those travelled on was affirmed at the American Association for the Advancement of Science by Prof. S. S. Haldeman, of Harrisburg, Pennsylvania, and has been confirmed by Prof. Van der Weyde.

Prof. Wahl has, says the *Athenæum*, given the following statement of observations made by him during a balloon ascent with Prof. Wise. The maximum temperature observed at starting was 97 deg., which continued for 1,300 feet; at 2,000 feet it was 96 deg.; and at 3,800 feet, 85 deg. This gradual fall went on until the greatest altitude was attained, 8,743 feet, when the temperature was but 68 deg.

Prof. Tomlinson's experiments on films of oil formed on water, and his suggestions that they might be employed as a means of detecting adulteration, have engaged the attention of a lady, Miss Kate Crane, who, in the *American Journal of Pharmacy,* gives an account of her experiments, confirming all that Mr. Tomlinson has done—the different shapes taken by drops of oil allowed to fall on water, distinctly indicating the character of the oil.

A new form of galvanometer has been described by Prof. Guthrie in the October number of the "Philosophical Magazine." In general forms it looks somewhat like a common tortoise-balance, and its principle depends upon the measurement of the strength of the current by determining the mechanical force necessary to bring two electro-magnets within a given distance of each other, after they have been excited by the current so as to be mutually repellent. By means of this instrument the absolute magneto-value of the current may be readily determined.

Prof. Reusch, of Tubingen, has described in Poggendorff's *Annalen* some experiments on diffusion between dry and moist air in a glass tube, the two media being separated by a porous plate of hydrophane. The fine series of experiments of diffusion by the late Prof. Graham appear to have suggested a numerous class of experiments similar to the above, all of them confirming the law enunciated by Graham.

The Board of Trade have ordered a coelometer (Mr. Adams's instrument for illustrating elementary astronomy) to be placed in their examining department at Tower Hill; and the committee of Her Majesty's training ship Conway, at Birkenhead, have ordered one for the use of their boys.

The Institution of Civil Engineers intend in future to print—1st. Memoirs which, from their abstruse character, are more suited for private study than for reading and discussion before the members at large. 2nd. Abstracts of some of the more important essays published by analagous societies abroad, and in foreign engineering and technichal journals of repute, the design being to publish if possible a *Quarterly Journal,* which, in addition to being the official record of the Institution, shall accurately reflect the modifications and developments of engineering progress throughout the world.

The death of Dr. Lankester, F.R.S., has occurred since our last publication took place. He was born in 1814, within a mile of the town of Woodbridge, in Suffolk. He received his medical education at University College; after which, in 1839, he obtained his M.D. at Heidelberg. In 1845 he was elected a Fellow of the Royal Society, and in 1862 was appointed Coroner for Central Middlesex. Between two and three months ago symptoms of diabetes manifested themselves, and his death was directly caused by the formation of carbuncles, one of the most painful *sequelæ* of that disease. In connection with his lamented decease we may mention that the Coronership thus rendered vacant has been filled by the appointment of Dr. Hardwicke, late Deputy Coroner, an old member of the Inventors' Institute, and a most worthy successor to Dr. Lankester.

The Council of the Society for the Promotion of Scientific Industry are making arrangements for an exhibition in Manchester in 1875, of appliances for economizing labour.

Information has been received by the Liverpool Chamber of Commerce that the authorities of Algiers have resolved on holding a grand Exhibition there, to commence in November 1875, and continue until the following year.

The Felt Makers' Company of the City of London have agreed to offer the Freedom of the Company and money prizes for works of merit in that trade.

Proceedings of Societies.

ROYAL INSTITUTION.

NOVEMBER 2ND.—Warren De La Rue, Esq., D.C.L., V.P., in the chair.—Mr. C. F. Moxon, Sir D. L. Salomons, Bart., and Mr. H. A. Smith, were elected Members.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

NOVEMBER 3RD. —S. Birch, LL.D., President, in the chair.—The following papers were read: "The Languages of the Cuneiform Inscriptions of Elam and Media," by the Rev. A. H. Sayce, M.A., —and "Four new Syllabaries and a Bilingual Tablet," translated and edited by H. F. Talbot.

GEOGRAPHICAL SOCIETY.

NOVEMBER 10TH —Major General Sir H. C. Rawlinson, President, in the chair —The following gentlemen were elected Fellows. Major J. G. Forbes, R.E., Messrs. J. Booth, J. F. Edmonds, and W. Firth.—After the President's opening Address, the following paper was read: "On the Discovery of New Arctic Lands by the Austro Hungarian Expedition of 1872-74," by Lieut. Julius Payer.

GEOLOGICAL SOCIETY.

NOVEMBER 4TH.—J. Evans, Esq., President, in the chair.—Messrs H. M. Whitley and H. Brothers were elected Fellows.—The paper read was, "Notes on the Comparative Microscopic Rock Structure of some Ancient and Modern Volcanic Rocks," by Mr. J. C. Ward.

ENTOMOLOGICAL SOCIETY.

NOVEMBER 2ND.—Sir S. S. Saunders, President, in the chair.—Mr. M'Lachlan exhibited a printer's block (such as is used for printing posters) attacked by a species of Anobium, and said he was informed that the insect was causing serious damage to the printer's stock. The wood was believed to be pear-tree. He had recommended soaking them in a mixture of carbolic acid and water. Dr. Sharp communicated "Descriptions of new Genera and Species of Pselaphidæ and Scydmænidæ from Australia and New Zealand." He added some remarks respecting the importance of gaining a knowledge of the New Zealand Fauna, and commented on the probable extinction of many of the species at no very distant period.—Mr. Darwin communicated some remarks by Mrs. Barber, of Griqualand, South Africa, on the larva of *Papilio Nireus*, and especially with regard to the colour of the pupa in connexion with the objects on which it was placed, it appearing to assume a protective resemblance to the leaves or other adjacent objects. A discussion took place as to whether, as suggested by Mrs. Barber, some photographic influences might be at work; but Mr. Meldola stated that no known substance retained permanently the colour reflected on it by adjacent objects, but that there was no difficulty in believing that larvæ might become affected in colour by the colouring matter of the food plant, since chlorophyll, in an unaltered condition, had been found in the tissues of green larvæ.—Mr. O. Ward sent some notes on a spider's nest found in a quarry at Poissy, near the Seine, with remarks thereon by Mr. C. O. Waterhouse.—Mr. Butler communicated "Descriptions of Three New Species and a New Genus of Diurnal Lepidoptera from West Africa, in the collection of Mr. A. Swanzy."—Mr. C. O. Waterhouse read "Notes on Australian Coleoptera, with Descriptions of New Species."—Mr. Kirby contributed a review of Boisduval's "Monographie des Agaristidées," published in the *Revue et Magasin de Zoologie*, 1874.—The Rev. R. P. Murray communicated "Descriptions of some New Species of Butterflies, belonging to the [illegible]."

CHEMICAL SOCIETY.

NOVEMBER 4TH —Prof. Odling, President, in the chair. The following papers were read: "On Methylhexyl Carbinol," by Dr. C. Schorlemmer,—"On the Action of Organic Acids and their Anhydrides on the Natural Alkaloids," Part I., by Dr. C. R. A. Wright,—"Action of Bromine in the presence of Water on Bromopyrogallol and Bromopyrocatechin," by Dr. J. Stenhouse, —"Action of Baryta on Oil of Cloves," by Prof. A. H. Church, "Observations on the Use of Permanganate of Potash in Volumetric Analysis, and on the Estimation of Iron in Iron Ores," by Mr. G. A. Parnell,—"Further Researches on Bilirubin and its Compounds," by Dr. J. L. W. Thudichum.

MICROSCOPICAL SOCIETY.

NOVEMBER 4TH —C. Brooke, Esq., President, in the chair.—A number of donations to the Society were acknowledged.—Messrs. T. W. Williams and J. W. Goodinge were elected Fellows.—A paper by Dr. J. Fleming, "On Microscopical Leaf Fungi from the Himalayas," was taken as read; it was illustrated by drawings, and many of the species described had been identified by Mr. M. C. Cooke as being the same as those known in Europe.—A paper by the Rev. W. H. Dallinger and Dr. Drysdale, in continuance of their series "On the Life-History of the Monads," was read by the Secretary. It minutely described a form repeatedly met with in macerations of the heads of cod fish and salmon, and traced the development and reproduction in all stages, and was illustrated by drawings which were enlarged upon the black board by Mr. Charles Stewart. The observations had extended over several years, and had been conducted with the greatest care under various powers up to 1-50 inch. The results of experiments were also given, and conclusively showed that exposure to temperatures of 220° and 300° Fahr. had failed to destroy the germs of these organisms. Some interesting living objects, stated to be larval forms of the common cockle, were exhibited and described by Mr. Wood; but the similarity of these forms to some which were exhibited at the previous meeting, and presumed to be *Bucephalous polymorphus*, having been pointed out by Mr. Stewart, a discussion followed, in which Mr. Wood, Dr. Moore, Mr Slack, Mr. Stewart, and the President took part.

INSTITUTION OF CIVIL ENGINEERS.

NOVEMBER 10TH.—Mr. T. E. Harrison, President, in the chair.—The paper read was, "On the Nágpur Water-works; with Observations on the Rainfall, the Flow from the Ground, and Evaporation at Nágpur; and on the Fluctuation of Rainfall in India and in other Places," by Mr. A. R. Binnie, which we give in another column.

MATHEMATICAL SOCIETY.

NOVEMBER 12TH.—Dr. Hirst, President, in the chair. The chairman drew attention to the fact that, as on his entry upon his office two years ago he had to announce the death of Dr. Clebsch, so now, as he was vacating it, he had to tell the meeting of the loss the Society had sustained by the recent death of its sole remaining German Honorary Member, Dr. Otto Hesse.—The treasurer (Mr. S. Roberts) stated that Rayleigh's donation had been invested in Guaranteed Indian Railway Stock.—Dr. Hirst gave a short account of the history of this donation and its proposed application to help in defraying the expenses of publishing the Society's Proceedings, and in the purchase of mathematical journals.—The Council, and the gentlemen whose names were given a short time since in the *Athenæum* were declared to be duly elected.—Dr. J. Casey was elected a member. Mr. E. Carpmael was admitted into the Society. Messrs. H. Hart and Hudson were proposed for election.—Dr. Hirst gave an account of his paper on Correlation in Space,"—Mr. J. H. Rohrs read an abstract of his communication "On Tidal Retardation,"—and a paper by Prof. Wolstenholme, "On a New View of the Porism of the In- and Circumscribed Triangle," was taken as read.

ANTHROPOLOGICAL INSTITUTE.

NOVEMBER 20TH.—Professor Busk, President, in the chair.—Reports were read by Mr F. W. Rudler, "On the Anthropological Department of the British Association at Belfast," and by Mr. Hyde Clarke "On the Anthropological Section of the International Congress of Orientalists recently held in London."—A paper was read by Col. Lane Fox, "On a Series of Flint and Chert Arrow-heads and Flakes from the Rio Negro, Patagonia, with Some Remarks on the Stability of Form observable in Stone Implements." The series of specimens exhibited was selected from a collection of 500, gathered by Mr. W. H. Hudson on the margin of the river and over an extent of about ninety miles; and on the numerous lagoons, now mostly dry, with which the valley is everywhere intersected. The valleys in that region run through high terraced table-lands; and on the plateaux above there is no water and but very scanty vegetation, which would seem to indicate the improbability of their having been occupied by man. A number of the implements were discovered by Mr. Hudson on the sites of villages along the valley, and in circular flattened mounds of clay, measuring from six to eight feet in circumference. The different styles of workmanship observed in the different villages were not, in the opinion of Mr. Hudson, to be attributed to the variety of the material employed but to the degree of skill possessed by the inhabitants of such villages The author drew attention to the fact of the arrow heads having long fallen into disuse among the Tehuelches and other Patagonian tribes, who now employ, and for some centuries past have employed, the spear. Col. Fox proceeded to describe in detail the weapons and their varieties of workmanship, and showed that they all presented the same general features as implements found in the United States. He believed that, owing to our inability to understand the uncultured mental condition of savages and prehistoric races, we often lose sight of the inferences deducible from the stability of form observable in their arts and implements, and attach less importance than should be attached to minute varieties of structure.—It was announced that the Council had resolved to publish in the Journal of the Institute, bibliographical notices, abstracts and reviews of English and foreign works and papers, and other miscellaneous matter of anthropological interest and importance.

ZOOLOGICAL SOCIETY OF LONDON.

NOVEMBER 3rd, 1874.—Dr. A. Günther, F.R.S., V.P., in the chair.—The secretary read a report on the additions that had been made to the society's menagerie during the months of June, July, August and September, 1874, and called particular attention to a pair of Arabian gazelles (*Gazella arabica*, Hempr. et Ehr.), from Aden, presented by Mrs. Benecke, July 25th; two specimens of a remarkable large skink (*Macroscincus coctæi*) found in [illegible], one of the smaller islands of the Cape de Verd group, presented by Professor Barboza du Bocage, C.M.Z.S., August 14th; and a one-wattled cassowary (*Casuarius uni-appendiculatus*), obtained in New Guinea, and presented by Captain Maitby, R.N., of H.M.S. Basilisk, August 25th. Mr. Sclater gave an account of some visits he had recently made to several Zoological Gardens and Museums in France and Italy, and made remarks upon some of the principal objects noticed therein. Mr. G. Dawson Rowley, F.Z.S., exhibited and made remarks upon [illegible] from New Zealand, amongst which [illegible]

fine examples of *Apteryx haasti*, and a living pair of *Dacelo[illegible] albiventris*. Mr. A. R. Wallace, F.Z.S., exhibited some rhinoceros horns, obtained in Borneo, by Mr. Everett, proving that this animal was still found living in that island. Mr. J. Gould, F.Z.S., exhibited a drawing of a new parrot, of the genus *Aprosmictus*, recently obtained on the Darling Downs, in Queensland. Mr. Gould proposed to call this bird *Aprosmictus insignissimus*. A letter from Mr. Swinhoe was read respecting some bats obtained by him at Ningpo. A communication was read from M. L. Taczanowski, conservator of the museum at Warsaw, in which he gave a list of the birds collected by M. Constantine Jelski, in the central part of Western Peru. Amongst these were 18 species described as new to science. A communication was read from Mr. Frederick Moore, giving descriptions of some new Asiatic lepidoptera. A communication was read from Mr. George Gulliver, F.Z.S., containing measurements of the red corpuscles of the blood of *Hippopotamus amphibius*, *Otaria jubata*, and *Trichecus rosmarus*. Mr. R. Bowdler Sharpe, F.Z.S., read a paper entitled, Contributions to a History of the Accipitres or Birds of Prey. The first of this series contained notes on the females of the common and South African kestrels. A communication was read from Mr. Henry Adams, giving the descriptions of some new species of shells from various localities, also of a new genus of bivalves from Mauritius. Mr. A. H. Garrod read a paper on points in the anatomy of the parrots which bear on the classification of the sub-order. This memoir was based upon the examination of a large number of individuals belonging to 79 species, chiefly from the society's living collection, and contained a new arrangement of the group based principally upon the arrangement of the carotid arteries, and, the presence or absence of the *ambiens* muscle, the *furcula* and the oil-gland. A communication was read from Mr. G. B. Sowerby, jun., giving the descriptions of five new species of shells from different localities. A communication was read from Mr. E. P. Ramsay, C.M.Z.S., wherein he described five new species of Australian birds, and of the egg of *Chlamydodera maculata*. The birds described were *Cypselus terræ reginæ*, *Æluroedus maculosus*, *Ptilotis frenata*, *Eopsaltria inornata*, and *Rhipidura superciliosa*.

November 17th.—George Busk, Esq., F.R.S., V.P., in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of October, and called particular attention to a Gentoo Penguin (*Pygoscelis taeniatus*) from the Falkland Islands, purchased October 22nd, being the first example of this species of Penguin received alive, and a Tooth-billed Pigeon (*Didunculus strigirostris*) from the Samoan Islands, deposited by Mrs. Boddam-Whetham, October 23rd. The Secretary exhibited on behalf of the Rev. J. S. Whitmee, C.M.Z.S., an egg of *Pareudiastes pacificus*, and an accompanying egg of the Samoan *Porphyrio*. A communication was read from Sir Victor Brooke, Bart., containing some remarks on the identity of a certain deer in the Society's collection, which had been determined as *Cervus [illegible]*. A series of eggs of [illegible] ([illegible]) transmitted by Mr. John Brazier, C.M.Z.S., was exhibited. These had been obtained from different islands of the Solomon group. Mr. E. B. Sharpe also exhibited some Megapodes' eggs from the southern part of New Guinea. Professor Mivart read a paper on the axial skeleton of the Struthionidæ, and pointed out that, judging by the characters of the axial skeleton, the Emeu presents the least [illegible] from which *Rhea* diverges [illegible] on the one hand and *Apteryx* on the other [illegible] the resemblance between [illegible] is exceedingly close, [illegible] mediate [illegible]

Apteryx; the affinities, however, with the existing New Zealand form very decidedly predominating. A communication was read from Major H. H. Godwin-Austen, F.Z.S., describing five new species of *Helicidæ*, of the sub-genus *Plectopylis*, from the Khasi and Naga Hills, from Darjeeling and from the Burmese region. Mr. R. Bowdler Sharpe, F.Z.S., read a paper on the Larks of Southern Africa, in which an attempt was made to reduce into order numerous genera and species of this difficult group. A communication was read from Dr. John Anderson, F.Z.S., pointing out that his *Macacus brunneus* was truly distinct from *M. arctoides* of Geoffr. St. Hillaire. A communication was read from the Count Turati and Dr. T. Salvadori, describing a new Trogon of the genus *Pharomacrus*, proposed to be called *P. xanthogaster*. Dr. Albert Gunther read a description of a new species of Kangaroo from N.W. Australia proposed to be called *Halmaturus apicalis*. Mr. P. L. Sclater read a notice of some specimens of the Black Wolf of Tibet now or lately living in the Society's Menagerie. Mr. H. E. Dresser exhibited Eggs of the various European species of *Hypolais*, together with those of *Acrocephalus streperus* and *A. palustris*, and pointed out that these two groups (*Hypolais* and *Acrocephalus*) approach each other in their eggs as well as in other characters, the two nearest allied in each group being *Hypolais rama* and *Acrocephalus palustris*. Mr. W. T. Blanford read a notice of two new Uromasticine Lizards from Mesopotamia and Southern Persia, proposed to be called *Uromastix microlepis* and *Centrotrachelus loricatus*. A second paper by Mr. Blanford contained descriptions of two new species of Ichneumon and of a Hare collected by Mr. F. Day in Sind, and new to the Indian Fauna. One of the former and the Hare were believed to be new to science and were called *Herpestes ferrugineus* and *Lepus dayanus*.

The next meeting of this society for scientific business will be held at the Society's House, in Hanover Square, on Tuesday, the 1st of December, 1874, at half-past Eight o'clock p.m.

SYNTHETIC DIVISION IN ARITHMETIC.

By Edward David Hearn, M.A., Columbia College, New York.

In the June number of Scientific Review I suggested an extension of Horner's synthetic process for the division of algebraic quantities and have since been entrusted by President Barnard, of Columbia, the editor-in-chief of the great American cyclopædia now publishing—"Johnson's New Universal Cyclopædia: a Scientific and Popular Treasury of Useful Knowledge"—with the articles bearing upon the subject, Horner's process, cubic equations and Suffield's process, in referring to which De Morgan, in his "Budget of Paradoxes," says:—"These paradoxes of calculation sometimes appear as illustrations of the value of a new method. In 1863 Mr. G. Suffield, M.A., and Mr. J. R. Lunn, M.A., of Clare College and of St. John's College, Cambridge, published the whole quotient of 10000 ..... divided by 7699 throughout one of the recurring periods, having 7698 digits. This was done in illustration of Mr. Suffield's method of synthetic division."

Now, although more than ten years had elapsed since the discovery of the method, it appeared to be quite unknown in America, and I almost despaired of finding anyone who had even heard of it in this country; but in reply to an enquiry through the *Mining Journal*, a lady relative of the author, now dead, kindly furnished me with an explanation of the system, which will now be described in popular language, and so as to be intelligible to those who understand the [illegible] only. We know that if we multiply the divisor and the quotient into each other the product will be equal to the dividend, and in certain cases we shall be able to observe the quotient itself occupying a place among the partial products obtained in the process of multiplication; thus 305,963 ÷ 401 = 763, and multiplying the quotient by the divisor, we have

$$\begin{array}{r} 763 \\ 401 \\ \hline 763^{*} \\ 305{,}200 \\ \hline 305{,}963 \end{array}$$

where the partial product marked * is the quotient itself, and the other partial product is 400 times greater than the quotient, so that if we can find a means of taking away 400 times the quotient from the product we shall have the true quotient. But as we do not know the true quotient, we cannot at once determine what figures will represent 400 times the true quotient; yet, as a sufficient portion of the larger partial product, is unaffected by the partial product obtained by the multiplication by the unit figure to enable us to find the first figure of the true quotient we can readily find the product of the true quotient multiplied by 400. Taking the dividend 305,963, we first divide the 30 by 4, which gives us 7 with a remainder (at present we only want the 7), and we know this 7 must be that resulting from the multiplication of the figure in the hundreds place of the true quotient by that in the units place of the divisor; if, therefore, we subtract this 7 from the figure in the hundreds place of the dividend, we shall obtain the fourth figure of the larger partial product, 7 from 9 leaves 2, and as the fifth and sixth figures must be ciphers, 305,200 must be equal to the true quotient multiplied by 400, and since by subtraction,

$$\begin{array}{r} 305{,}963 \\ 305{,}200 \\ \hline 763 \end{array}$$

it follows that 763 is the quotient resulting from the division of 305,963 by 401. This is synthetic division *subtractive*, and in practice is performed thus

$$\begin{array}{r} 4)305{\cdot}963 \\ \hline 763 \end{array}$$

The mental process is thus. We say 4 in 30=7 and 2 over, write 7 under 9; 4 in 25=6 and 1 over; write 6 under 6; 4 in (19−7) 12=3 and no remainder, 4 in 6−6=0, 4 in 3−3=0 therefore 763 is the exact quotient arising from the division of 305,963 by 401. To facilitate synthetic division in arithmetic it is desirable to have the divisor near 10, or some multiple of 10; yet the divisor must not be 10, nor any multiple nor aliquot part of 10. Suitable divisors are obtained by multiplying or dividing both dividend and divisor by one and the same number. Suppose, for example, we require to divide 1,419,564 by 234, we divide both dividend and divisor by 6, and then quickly obtain the true quotient by short synthetic division *additive*, thus,

$$\begin{array}{rr} 6)234 & 6)1419564 \\ \hline 39 = \text{Syn. D., } 4' & 4')236594 \\ \hline & [illegible] \end{array}$$

Here 6 is an ordinary divisor, and 4' a synthetic divisor. In the synthetic division the mental process is, 4 in 23=5 [illegible] write 6 under 6; 4 in (6+6—10, for the [illegible] must of course be carried as 10, because we are using it with figures one place lower in the scale of local value) 2=5 and carry [illegible] write 0 under 5; 4 in 25+0=6 and carry 1 [illegible] 4 in 19+6=6 and carry 1. As we have now reached the decimal point in the dividend we must place the decimal point in the quotient. We continue 4 in 14+6; 4 in 9+5; [illegible] 1; 4 in 30+2; 4 in 9+8; 4 in [illegible] 2 over; and as this is a [illegible] occurred before we know that the period [illegible]

completed, and that 1,410,564 ÷ 234 is equal to 6066·512820

The rule is first to multiply or divide the divisor by a number that will bring it very near to a multiple of 10 (401 is already a suitable divisor and 234 ÷ 6 = 39); next add or subtract that figure which will make the partially converted divisor (401 or 39) a multiple of 10 (400 or 40), and having multiplied or divided the dividend by the figure used to manipulate the divisor, point off in the converted dividend as many decimal places commencing at the units place as there are ciphers in the converted divisor (400 or 40). Place the first figure of the quotient as many places from the beginning of the converted dividend as would be required for the first division by the synthetic divisor with the ciphers annexed (we must have 3059 to divide by 400, and 236 to divide by 40, we therefore, place the first figure of the quotient under the 9 or four places, and under the 6 or three places from the beginning respectively). Divide as in the ordinary process, but add in the quotient figure standing in vertical line, with the figure of the dividend which is being manipulated. The integer portion of the quotient will be complete when the decimal point in the dividend is reached.

The general principle of the process will now be readily understood, and likewise the reason of Mr Suffield's rule "To find Q, the quotient of A ÷ B, let

$$a^{n-1},\ a^{n-2},\ \&c.,\ a^1,\ a^0$$

be the digits in the n last places of B. Then if

$$9\text{-}a^{n-1},\ 9\text{-}a^{n-2},\ \&c.,\ 9\text{-}a^1,\ 10\text{-}a^0$$

be added respectively to these digits, it will convert B. into a number with a significant part (which call the Synthetic Divisor) followed by n ciphers. Point off n places of decimals from the units place of A, and divide it by the synthetic divisor so as to find q the first figure of Q, then above or below each of the n places of the dividend which would in common division have to be brought down to find the next n figures of the quotient write

$$(9\text{-}a^{n-1})q,\ (9\text{-}a^{n-2})q,\ \&c.,\ (9\text{-}a^1)q,\ (10\text{-}a^0)q$$

respectively, leaving room to the right hand of each multiple for the same multiple of all the other figures of the quotient when found."

If the n last digits of the divisor be each, 9, the general rule will be much simplified. There can be no doubt that Mr. Suffield's process is capable of very extensive application, and it is regrettable that it has not hitherto become more generally known. With very little practice synthetic division is quite as easy as ordinary division, and it is especially valuable because it abbreviates to an extraordinary degree calculations which, by the usual processes of division, are long and tedious.

As many may like to know something of the inventor of the process, it may be stated that Mr. Geo Suffield, M.A., of the University of Cambridge, graduated from Caius College as a wrangler in 1842, and afterwards became a Fellow of Clare College and one of the University examiners. He was a man of varied accomplishments, of high ability, of almost primitive simplicity of life and manners, and noble integrity of character. He was much devoted to science, and whilst residing in his University engaged in researches which he never lived to accomplish. He was carried off by small-pox in 1870. De Morgan considered that he was "on the scent of investigations of great [illegible];" and let us hope that others will [illegible] the useful work which he was un[illegible].

SOME OTHER SCHOOL BOARD DOINGS

As we see no hope that education will be speedily popularized unless the public elementary school authorities are made to understand (by bringing public opinion to bear on them) that zeal without discretion is worse than useless for that object, we publish the following extracts from the *Daily Telegraph* (25th and 26th Nov):—

"An inquest was held yesterday at the Peacock Tavern, Cambridge Heath road, Bethnal green, upon the body of Mary Ann Dowsett, 4, who had died under peculiar circumstances. The mother of the deceased deposed that her little girl, who, prior to the 19th October, was in good health, went together with her sister to a board school in Globe street. On the afternoon of that day she came home much frightened and stated that she had been placed in a cupboard in the schoolroom as a punishment. Since that time, and up to her death, she used to wake up in the night and exclaim "Mother, they did put me in the cupboard and dragged me off the gallery." She expired on the 19th inst. Lillie West, a girl about fifteen, and a paid monitor of the school, who, it was alleged, had placed the deceased in the cupboard, gave an emphatic denial to the allegation. The girl was unruly, and she punished her by placing her on a form for about two minutes, together with other children who had also misbehaved themselves. After the children had been dismissed from school she saw the deceased and her sister crying, and the former stated that she had been frightened by a boy who had threatened to put her in the coal-cellar. Medical evidence showed that the cause of death was gastric fever, which would be aggravated by fright. Ultimately the jury returned a verdict 'That the death of the deceased was accelerated by fright, through being put in a cupboard at school, and that the monitor was too young to have the power of punishing children.'"

"At the Southampton Borough Bench yesterday Wm. Goffe, the school attendance officer was charged with assaulting James Walter Dyson, aged six years, the son of the South Western Company's district superintendent. The nurse said she was out with the children, one of whom was riding a donkey, when they were stopped by the officer and cross examined by him as to whether they attended school and on both servant and the children refusing to satisfy his curiosity, he took the complainant by the shoulders and shook him violently much frightening him. The defendant was fined 20s and costs."

SCIENCE GOSSIP.

The medals in the gift of the Royal Society for the present year have been awarded by the Council as follows:—The Copley Medal to Prof. Louis Pasteur, the Rumford Medal to Mr J. N. Lockyer, a Royal Medal to Prof. W. C. Williamson, and another Royal Medal to Mr. H. C. Sorby.

Prof. Cameron has a new work in the press entitled, "A Manual of Public and Private Hygiene, for Officers of Health, Boards of Guardians, and Sanitarians Generally." The work will be issued by Messrs. Baillière, Tindall, and Cox.

It is understood that Mr. Beauchamp Tower, already known as the inventor of "Tower's Speed Indicator," has just completed, under the auspices of Sir William Armstrong's Company, a most successful series of experiments with an automatically propelled torpedo. Its range and speed are such as to justify the conclusions of those most qualified to judge that it may not only rival, but supersede the Whitehead Fish Torpedo.

In reply to a petition praying permission to erect a memorial to Jeremiah Horrocks within the walls of Westminster Abbey, the Dean and Chapter have signified their willingness to admit a tablet, and have reduced the fee ordinarily payable to the sum of £25. A subscription, in which it has been thought well to restrict the donations to the sums of one guinea and under, has been set on foot. Should there be any surplus, it has been proposed to appropriate it to the purchase of books, to be deposited in the library of the Royal Astronomical Society; or, if the surplus should be of sufficient amount, to invest it in the name of trustees upon trust, to apply the interest for the purchase of books or for the general purposes of the library. Among the subscribers are Prof Adams, of Cambridge, Sir George Airy the Baroness Burdett-Coutts, the Duke of Devonshire, Mr. E. Dunkin, Prof J H Gladstone, Prof. Grant, Dr Huggins, Lord Lindsay, the Bishop of Manchester, Prof. Pritchard, the Earl of Ross, and Prof J. S Smith.

At the Port Clarence works, belonging to the Messrs Bell Brothers, an excellent deposit of salt has been found. The Diamond Boring Company has been engaged in boring for nearly a year, and their perseverance has at length been rewarded with the discovery of salt near Middlesbrough. The value of this to the chemical works of the Tees and the Tyne cannot be over estimated.

It cannot be too generally known that many vessels which are sold as being tinned are really coated with a mixture of tin and lead. M. Fordos has addressed a paper to the Académie des Sciences, in which he states that water, acidulated with only 1 per cent. of acetic acid being allowed to stand in such vessels dissolves out some of the lead. Therefore, such vessels are likely to prove injurious and should be guarded against.

APPLICATIONS FOR LETTERS PATENT.

Continued from page 170.

On September 24th.—3260 to 3279.—C. P. Shrewsbury. Fly or taking-off apparatus for printing machines.—A. Davidson and B. Goldstein. Apparatus for obtaining motive power.—W. F. Thomas. Sewing machines.—A. H. Maclean. Apparatus for feeding wool, cotton, or other fibrous materials to carding or other machines.—W. McNaught, sen., J. McNaught, and W. McNaught, jun. Steam-engines.—S. Lester and E. Horwood. Apparatus employed for crimping, creasing, or folding woven fabrics, lace, leather, or other materials (com.)—D. de Lara and H. T. Sewell. Apparatus for preventing injury to vessels in collision at sea.—W. B. Pushey. Rotatory engines.—J. B. Clark. Ships' anchors and appliances connected therewith, and ships' hawse holes for the same, and for other anchors.—R. P. Spice. Apparatus used in the manufacture of gas.—J. Simpson and S. T. Fawcett. Construction of perambulators, rendering them applicable to swings.—H. A. Bonneville. Apparatus for the application of wire coverings for securing the corks of bottles containing sparkling wines or other fermented or effervescent liquids (com.)—H. A. Bonneville. Machinery for corking bottles (com.) (Complete specification.)—H. A. Bonneville. Jack (com.)—H. Bessemer. Apparatus for regulating or controlling the motion of suspended saloons, cabins, floors or platforms of steam or sailing vessels. (Complete specification.—W. Ladd and A Hilger. Spectroscopes.—T. Kendall. Burial vaults and graves and means of burying the dead.—L. G. E. J. [illegible] and W. Webster. Apparatus for stamping and inking bonds, shares, bills, and other documents.—J. Crawford. Fenders and other articles ordinarily used in connection therewith.—H. L. Jones. Combined flushing and deodorising and disinfecting apparatus for use in urinals, waterclosets, and similar purposes.

On September 25th.—3280 to 3297.—R. [illegible]. Construction of iron fences.—A. J. V. Day. Manufacture of gas and the means or apparatus employed therefor (com.)—W. Allen. Making metal [illegible] blocking.—W. [illegible].—Cooking ranges.—T. H. Thompson. Marine [illegible].—J. Anderson and L. [illegible]. Window [illegible] and parts connected therewith.—W.

Thomas. Weaving [illegible] and figured fabrics.—G. Farmer. Construction of cocks and valves for controlling the flow of liquids and fluids.—R. R. Moffatt. Ordnance and projectiles.—R. Coddington. Telegraphy (com.) (Complete specification.)—R. Marriott. Construction of boilers for heating liquids and generating steam.—P. Jensen. Machine or appliances for folding and pressing trimmings, bindings, and other articles made of textile fabrics (com.)—W. Darlaston and W. Hawkins. Apparatus for the preventing or diminishing of smoke in steam boiler and other furnaces.—C. D. Abel. Break apparatus for the rolling stock of railways (com.)—R. Hornsby and J. Scott. Steam boiler furnaces, and apparatus connected therewith.—W. R. Lake. Apparatus for evaporating saccharine and other solutions.—W. McNabb. Machinery for compressing various descriptions of merchandise into bales or packages, and also for other purposes where compressing, bending, or lifting is necessary.—A. Turner. Manufacture of elastic fabrics.

On September 26th.—3298 to 3309.—E. Entwistle. Suspenders or bearers for tubes, rods, wire, or other equivalents.—W. Walker. Rock-drilling machinery.—R. Kerr. Making up for sale or use sewing thread of cotton, linen, or silk.—J. S. Rogers. Catch and slip hooks applicable to boat lowering and other mechanism or purposes on board ship, vehicles, cranes, and other machines or apparatus.—T. Wright. Signalling on railways, and the machinery or apparatus employed therefor.—J. W. Harland. Handles for locks, latches, doors, and other articles to which knobs or handles are applied.—M. G. White. Self-acting apparatus for regulating the supply of water or other liquids.—B. Samuelson and W. G. Manwaring. Harvesting machines.—R. Berryman. Apparatus for circulating, heating, and purifying the feed water for steam-boilers, and the connections of or mode of attaching such apparatus to the said boilers.—T. B. Redwood. Manufacture of gas for burning.—W. Brownlie. Mode and means of exhibiting or giving publicity to trade marks and advertisements.—A. Sézille. Bread making from bread stuffs without reducing them to flour by chemical decortication.

On September 28th.—3310 to 3324.—J. E. H. Andrew. Machinery for twisting, compressing, and rolling tobacco.—E. G. Wright. Electrical burglar alarms (com.)—A. Gilbertson, E. Gething, W. Gething, and D. Jenkins. Cleaning, finishing, and completing plates coated with tin or terne, and apparatus therefor.—T. Carr. Method of and apparatus for knitting mail or other kinds of healds used in the manufacture of cotton, worsted, or textile fabrics.—T. H. Henderson. Machinery and apparatus to be employed in puddling iron.—G. Allix. Rotary engines.—J. W. Jones. Portable points, inclines, or apparatus for transferring tramway cars or carriages from one line to another.—R. George. Flower pots, troughs, and plant holders, and the means of supplying fluid or moisture to trees, plants, cuttings, growing crops, and seeds.—J. Wallace. Gas burners and apparatus connected therewith.—H. Bessemer. Apparatus for collecting and storing water for the supply of towns, villages, dwelling houses, factories, and chemical or other works, and for agricultural purposes.—J. Whelan. Apparatus for cooking and effecting other similar domestic requirements.—M. F. Cooke. Horseshoes. (Complete specification.)—F. Dennison and F. H. Dennison. Rotary web perfecting printing machine.—F. Wirth. Oil-colour (com.)—G. Beaven and A. Miller. Mode of or process and apparatus for destroying or decomposing the noxious gases given off from kilns, drying floors, and other places or manufactures.

On September 29th.—3325 to 3338.—H. G. Paterson. Construction or manufacture of [illegible] and other articles from [illegible].—F. T. [illegible], M.D. Treatment of slops, [illegible] waters, and other forms of liquid refuse, and for apparatus to be used therein.—F. F. F. [illegible]. Paper bag making machines (com.) (Complete specification.)—E. [illegible]. Tip for [illegible] for weaving.—J. [illegible]. Saddles.—F. T. [illegible], M.D. Construction of dry and water closets, and apparatus to be used therein.—W. Anderson. [illegible] machines. (Complete specification.)—G. H. [illegible] and E. [illegible]. Purification of [illegible].—G. H. Gill and F. H. G. Gill. [illegible] separating [illegible].—E. D. [illegible]. Manufacture [illegible].—W. Thomas. [illegible]

D. Nicoll. Preparing, dressing, and waterproofing woollen fabrics, commonly known as sanitary cloth, and other similar fabrics.—T. Bradford. Churns or apparatus for making butter.—T. Bradford. Machinery or apparatus for washing, wringing, and mangling.

On September 30th.—3339 to 3351.—T. Clarke, M.D. Method of treating low-class and other ores, for obtaining copper and silver therefrom.—Rev. G. H. Forbes. Manufacture of cement.—B. Kapsel. Lubricators (com.)—R. Edwards. Reciprocating engine driven by steam, compressed air, or other fluid, and used for drilling holes in rocks, or for other purposes, and supports for such engines.—W. Whitthread. Cleansing and revivifying charcoal.—J. O. Mewburn. Machinery to be employed in collecting and binding corn, straw, or hay (com.)—W. H. Westwood, F. Wright, and E. T. Wright. Stop or regulating valves for regulating or controlling the passage of liquids and gases through pipes or tubes, and for other like purposes.—F. Robinson. Mode of and apparatus for the manufacture of gas.—S. Wilkerson, jun. Machinery or apparatus for weighing and lifting, or for weighing, lifting, emptying, and filling sacks or similar receptacles.—E. Peck. Fastenings for window sashes.—A. L. Mahler and An. Mahler. Manufacture of fabrics suitable for bodies, skirts, and other similar articles of ladies' wearing apparel.—F. F. Burlock. Looms (com.)—W. R. Lake. Galvano-hydrostatic apparatus for igniting, illuminating, and telegraphic purposes (com.)

On October 1st.—3352 to 3365.—J. H. Lynde. Apparatus for saving water in waterclosets, urinals, &c., where a fixed quantity of water is required at each operation.—O. Altendorf. Revolving pistols and other small arms (com.)—R. Smith. Machinery for doubling and winding cotton and other yarns and threads.—J. J. B. Mills. Machinery or apparatus for making wood splints for matches, and for other purposes (com.)—R. Stone. Manufacture of iron and other metals, and the smelting or extracting of such metals from their ores.—K. G. Brewer. Manufacture of door knobs or handles, and the mode and means employed for attaching same to their spindles (com.)—F. B. Michell. Stopper for bottles for containing gaseous and other liquids, whereby filling, stoppering, and opening such bottles can be effected.—A. Moullard. Apparatus for composing and transmitting the signs or letters of Morse's telegraphic apparatus.—J. Binsepal and G. T. Pointer. Dress improvers or bustles for personal wear.—M. Benson. Steam pumping or air compressing engines and machinery (com.)—A. Strauss. Additions to pipes for smoking, the additions being also available for cigars and cigarettes.—J. Horle. New puzzle game, named "The Spanish Question."—G. R. Byrant. Washing of wool or other similar material by machinery.—A. Smith and G. Wilson. Means or method for preventing fraudulent use of railway and other passes.

On October 2nd.—3366 to 3371.—J. Beck. Apparatus employed in the making and condensing of oxygen and hydrogen gases (com.)—W. R. Evans. Casting metal grating for pavement lights and for other purposes.—W. H. Thompson. Machinery for cutting, working, or operating upon stone, wood, and other materials.—M. Benson. Fastenings for joining metal bands or sheets of metal together (com.)—J. Kellow. Apparatus for signalling to drivers, conductors, and guards of railway trains for the prevention of accidents, and for other purposes.—H. W. Cook. Apparatus for propelling vessels through air or water.

On October 3rd.—3372 to 3392.—C. R. S. Webb. Rocking apparatus.—S. G. Browne. Steam engines.—G. S. Fleming. Candlesticks.—T. Griffin. Metallic cases for preserved provisions and other articles.—W. E. Gedge. Motive power apparatus specially applicable to sewing machines (com.)—R. Hunt. Purification of air in confined spaces and the means to be employed therein (com.)—A. H. Beavan. Means employed for stowing cattle and horses on board ship.—E. Parkinson. Lamps or lanterns (com.)—H. E. Newton. Embroidery attachments applicable to sewing machines (com.)—C. Gilstone, J. [illegible], and M. Gray. Means for communicating between passengers and the guard and engine driver of railway trains.—F. [illegible] [illegible]

jewellery.—F. A. [illegible]. Treatment of human excreta and the manufacture of manure therefrom, and the apparatus employed therein.—O. J. Christie. Construction of potato digging machines, the application of riddles thereto, and the combination of these improvements with reaping machines whereby the latter may be readily converted to serve the purpose of potato-digging machines and reconverted to their original use as required.—C. Wilhelm. Apparatus for earth-boring (com.)—[illegible] Baronio. Envelope and letter sheet or postal memorandum form.—E. Priestman and W. Crook. Machinery for combing wool and other fibres.—T. Longworth and F. L. Jones. Looms for weaving.—H. C. Mance. Apparatus for telegraphing by means of reflected light.—T. Jubb and J. Dransfield. Feeding machinery or apparatus for woollen or other fibrous substances.—A. M. Clark. Preserving wood (com.)

On October 5th.—3393 to 3401.—D. Rankin. Marine engines for driving paddles.—G. Dyson. Coats and other articles of wearing apparel.—W. Y. Marston. Holders or files for holding or filing letters, invoices, music, and other papers.—A. Brown. Manufacture of alloys of iron (com.)—D. Thomson. Rock boring machinery.—J. Higginbottom and E. Hutchinson. Method of supplying air to millstones, and the apparatus used therefor.—H. Gardner. Breech-loading cannon and projectiles for the same, and for other guns of large calibre (com.)—E. G. Banner. Apparatus for ventilating sewers, drains, rooms, and other buildings.—A. M. Clark. Embroidering machine (com.)

On October 6th.—3402 to 3421.—E. Hawken. Appliances for economising the consumption of fuel.—J. Unwin. Coating or plating with copper boilers and boiler plates of iron.—H. Trotter. Self-lighting and extinguishing apparatus.—R. Ainsworth. Screw tap.—W. S. Gedge. Self-acting mill for grinding coffee and other substances (com.)—W. E. Gedge. Multiplying the forces of motive power engines generally (com.)—J. Robbins, J. Wood, and J. Allbut. Manufacture of chilled rolls for rolling and planishing metals, and for other like purposes.—W. Cotton. Manufacture of looped fabrics, and apparatus employed therein.—W. Shaw. Construction of printers' type cases.—W. H. Fry, T. J. Fry, and T. Fry, jun. Manufacture and production of valances and draperies, and similar woven materials.—I. Cowley. Machinery for cutting and paring oil and other cakes made from vegetable seeds.—G. Owen. Dry earth closet, cinder sieve, rubbish screen, dust bin, and box for the storage of dry earth.—F. H. W. Higgins. Automatic fire and burglar alarms applicable to dwellings and warehouses, and in other places.—G. H. M. Muntz. Manufacture of lap welded iron tubes and other tubes, and of skelps for the manufacture of iron tubes and other tubes.—J. Wilson. Steam boilers.—T. Scott. Saving of nitre in the manufacture of sulphuric acid and apparatus therefor.—J. Hutchinson. Preparing yarns for the manufacture of thread and the machinery employed therefor.—J. Stirling and T. Peacock. Consuming gaseous products of combustion produced in furnaces and fire-grates generally, and the means or apparatus employed therefor.—A. M. Clark. Electric battery and methods of preparing the same (com.)—A. R. Holland. Shirts.

On October 7th.—3422 to 3440.—T. Murray and S. Crighton. Apparatus employed in the manufacture of earthenware bottles and other earthenware or pottery ware articles.—J. Woodcock. Methods of and apparatus for lubricating the slides of steam engines and other machinery, and for filtering the lubricant employed.—W. M. Scott. Breech-loading fire-arms.—J. Siddeley and F. N. Mackay. Cooling, refrigerating, and ice-making, and apparatus employed therein.—M. Mondon. Machine for cutting files.—J. Hitchen. Means and apparatus for hoisting and lowering goods, merchandise, or other articles by hydraulic power.—G. Haseltine. Mode of and means for supplying water to steam boilers (com.)—W. H. Hanstone and J. Thorpe. Production of those fabrics which are formed of cloth, paper, or other like material coated with a waterproof composition.—F. Connor. Machinery for beetling fabrics, yarns, and fibrous substances.—J. H. Johnson. Tanning, and apparatus employed therein (com.)—T. E. Johnson. Process of producing stereotype and electrotype plates or blocks from lithographic stones for letter-press [illegible] similar purposes.—I. B. Hardy. [illegible] mats for use in doorways, [illegible]—W. E. Newton. [illegible]

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